Prepared for
Department of Infrastructure, Planning and Logistics
ABN: 84 085 734 992

Paru Road Supplementary Environmental Report

Paru Road Upgrade

01-Feb-2022
Paru Road Terrestrial Biodiversity Survey

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Paru Road Supplementary Environmental Report

Paru Road Upgrade

Client: Department of Infrastructure, Planning and Logistics

ABN: 84 085 734 992

Prepared by

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Date 01-Feb-2022

Prepared by William Riddell and David van den Hoek

Reviewed by Abe Francis

Revision History

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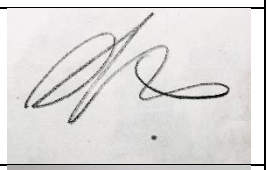
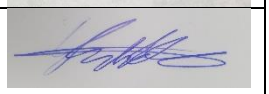
			Name/Position	Signature
A	25-Nov-2021	Draft for Review	Abe Francis Principal Environmental Scientist	
0	14-Dec-2021	Address client comments and submit final report	William Riddell Senior Environmental Scientist	
1	1-Feb-2022	Address comments from NT EPA and submit updated final report	William Riddell Senior Environmental Scientist	

Table of Contents

Executive Summary

The Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) is currently facilitating the upgrade of Paru Road on Melville Island, within NT Portion 1644. The project is expected to deliver several social and economic benefits to the Tiwi island including:

- Providing all-weather access between the communities and businesses on Bathurst and Melville Islands
- Providing employment opportunities from the upskilling of local peoples engaged in the works
- Providing certainty to businesses to facilitate the growth of existing Indigenous enterprises and potential establishment of new Indigenous enterprises on the Tiwi Islands.
- Improving education opportunities and outcomes through year-round access to schools
- Enabling year-round cultural tourism enterprise to be developed

AECOM developed an Environmental Impact Assessment (EIA), on behalf of DIPL, as formal notification to undertake construction works to upgrade Paru Road. Initial fieldwork was undertaken to inform the EIA in January 2021 and the application was submitted for assessment in March 2021 (AECOM 2021).

A *Direction to Provide Additional Information* was delivered by the Environmental Protection Authority (NT EPA) requesting additional project information regarding:

- **Terrestrial ecosystems**, including impacts to threatened mammals (Butler's Dunnart Sminthopsis butleri and Pale Field-rat Rattus tunneyi), impacts to large and very large trees, impacts to threatened monsoon vine forest flora species, and plans for weed management and gravel pit rehabilitation.
- **Water**, including water use and sources, flow regimes around the road construction, impacts to creek hydrology, water quality and drainage lines, and impacts to aquatic habitats
- **Community and economy**, including community consultation, opportunities to employ local Indigenous people, impacts to road users, accommodation of the workforce, and economic and social benefits to the local community

This supplementary environment report aims to address all requests for additional information outlined in the *Direction to Provide Additional Information* (NT EPA, 2021a).

Three qualified AECOM staff travelled to Melville Island to undertake terrestrial ecology surveys during 4 – 11 October 2021. One Tiwi ranger (Warrick Puruntatameri) assisted the field surveys for three days.

A total of 45 pitfall traps, 120 Elliot traps and 22 cameras were installed across the four gravel pits to detect Butler's Dunnart and Pale Field Rat. A total of 11 Butler's Dunnart and three pale Field-rats were detected during the October 2021 survey.

Assessment of large and very large trees determined that there was no significant difference between the number of large and very large trees within the proposed gravel pits, and the number of such trees in similar woodland habitat immediately adjacent to the gravel pits.

Transect surveys and vegetation mapping undertaken within the creek road alignment in January 2021 failed to detect threatened flora associated with monsoon vine forest . Moreover, suitable habitat for these species does not occur within the creek road alignment.

Three water sources are proposed for use to support Paru Road upgrade works. An Erosion and Sediment Control Plan (ESCP) will be developed and implemented during the project that will aim to prevent deleterious impacts to creek hydrology, water quality and aquatic habitats. The construction contractor will be required to implement the ESCP, as well as requirements of the NT Land Clearing Guidelines (DEPWS, 2021) and Standard Specification for Environmental Management (DIPL, 2019) to minimise impacts to surface water and groundwater along Paru Road.

The proposed gravel pits have been chosen to minimise impacts to threatened species, predominantly *Typhonium jonesii* and *T. mirabile* that were surveyed in January 2021. Total avoidance of impacts to

threatened species is not possible, due to the abundance of threatened fauna and flora species that occur on Melville Island. The woodland habitat that will be impacted by the Paru Road upgrade represents a small portion of the terrestrial ecosystems that occur on Melville Island. The project will not have significant deleterious impacts to the environment provided the mitigation measures outlined in this report, and the *Environmental Impact Assessment – Paru Road Upgrades – NT Portion 1644, Melville Island* (AECOM, 2021), are effectively implemented.

1.0 Introduction

1.1 Project Background

The Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) is currently facilitating the upgrade of Paru Road on Melville Island, within NT Portion 1644. AECOM developed an Environmental Impact Assessment (EIA), on behalf of DIPL, as formal notification to undertake construction works to upgrade Paru Road. Initial field work was undertaken to inform the EIA in January 2021 (AECOM 2021) and the application was submitted for assessment in March 2021.

A *Direction to Provide Additional Information* (NT EPA, 2021a) was delivered by the Environmental Protection Authority (NT EPA) to supplement the *Environment Protection Act 2019 Referral - Environmental Impact Assessment – Paru Road Upgrades – NT Portion 1644, Melville Island* (AECOM, 2021).

Table 1 below summarises the additional information requested by the NT EPA and identifies the section/s in this report where the information is provided.

Table 1 Information requested in Direction to Provide Additional Information (NT EPA, 2021a)

Environmental Factor	Referral reference	Information requested	Report Section
Terrestrial ecosystems	Submission from the Department of Environment, Parks and Water Security Referral section 3 and 5	Undertake sufficient additional survey within the proposal footprint to ensure that gravel pits can be located within areas where Pale Field-rat and Butler's Dunnart are known to be absent. If this is not possible, an additional regional survey would be required to clarify the significance of the local occurrence of these species.	Section 3.1
		Configure gravel pits to avoid areas in GP1-2 that have not been completely surveyed for Typhonium spp. If this is not possible, clarification of Typhonium spp. presence/absence and abundance within GP1-2 through an additional survey is required to ensure there is no significant impact on these species.	Figure 1 Un-surveyed areas within GP 1-2 have been removed
		Undertake additional sampling to assess the density of large (DBH>40 cm) and very large (DBH>50 cm) trees with the potential to support tree hollows within the areas proposed for clearing and provide a comparison with densities in surrounding areas of similar habitat to contextualise the potential impacts of the loss of large trees on habitat availability for relevant threatened species (Masked Owl, Brush-tailed Phascogale and Black-footed Tree-rat). Areas with relatively high densities of large hollow-bearing trees should be avoided where possible.	Section 3.2
		Provide additional survey details to demonstrate confidence about the absence of significant monsoon and riparian rainforest species from the riverine forest associated with the creek crossing on the Paru Road, and/or demonstrate that the habitat is not suitable for the species with the potential to occur in this area.	Section 2.1
		Provide further detail on the duration and content of the proposed weed management program to clearly demonstrate that the measures put in place to monitor the establishment, spread and control of weeds will minimise any risk to threatened species and their habitat.	Section 2.2 Appendix B
		Provide Rehabilitation Plans for the gravel pits and the sections of Paru Road to be replaced by the realignment works.	Appendix B

Environmental Factor	Referral reference	Information requested	Report Section
Hydrological processes, inland water environmental quality, and aquatic ecosystem	Submission from the Department of Environment, Parks and Water Security Referral section 3 and 5	Provide details about the amount of water that the proposal is expected to use and the water source that will be used. If water is to be sourced from local aquifers, a groundwater resource assessment should also be undertaken in relation to water availability and suitability.	Section 4.1 Appendix E
		Provide details to demonstrate that construction of the road would be designed to maintain natural flow regimes upstream and downstream of the road crossing the drainage lines and drainage of water from the road itself.	Section 4.2
		Provide details about the proposed creek crossing and measures to avoid any significant impacts to the creek hydrology, water quality and morphology of the aquatic habitat.	Section 4.3
		Provide details about the proposed North Road Realignment at Ch5300 – Ch6300 and the gravel pits to be developed within the Gravel Pit 1 Area and how impacts to the drainage lines and 1st order ephemeral streams adjacent to these works will be avoided	Section 4.4
		Clarify the presence and extent of any aquatic habitats within or adjacent to the proposed works and outline specific measures to be put in place to ensure potential impacts on sensitive receiving habitats are minimised through environmental management and erosion/sediment control systems.	Section 4.5
Community and economy	Submission from the Department of Chief Minister and Cabinet Referral section 5.13, 5.15	Provide information about consultation undertaken and planned with the local community, and how matters raised related to potentially significant impacts have been and/or will be considered and addressed.	Section 5.1
		Provide details about the proposed workforce including whether there will be opportunities to train and employ members of the local community.	Section 5.2
		Describe the potential adverse impacts to road users during construction, and how such impacts will be minimised.	Section 5.3
		Describe the logistics of accommodating the project workforce, and demonstrate measures to minimise any potential adverse impact on the wellbeing of the community.	Section 5.4

Environmental Factor	Referral reference	Information requested	Report Section
Community and economy	Submission from the Department of Chief Minister and Cabinet Referral section 5.13, 5.15	Provide an assessment of the potential economic impact of the construction/works on local communities.	Section 5.5
		Provide an assessment of the flow-on social and economic benefits for local businesses and communities as a result of the proposal.	Section 5.5 & Section 5.6

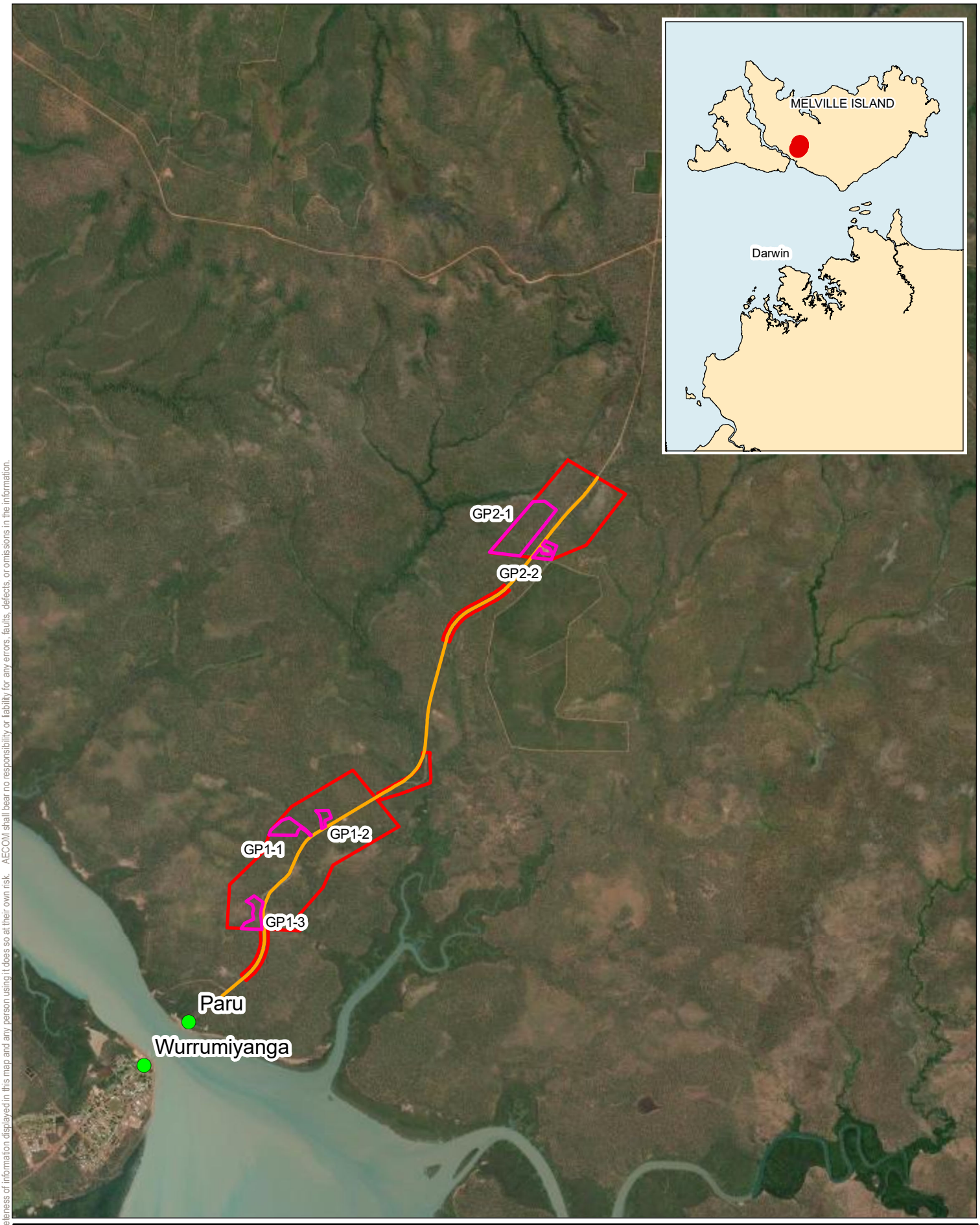
1.2 Objectives of this Report

The objectives of this supplementary environment report are to address all requests for additional information outlined in the *Direction to Provide Additional Information* (NT EPA, 2021a).

The *Direction to Provide Additional Information* is provided in Appendix A.

1.3 Project Location

The Tiwi Islands comprises two islands, Melville and Bathurst islands, located approximately 80 km north of Darwin in the Timor Sea. Melville Island is the larger and more populated of the two. The project areas occur along and adjacent to Paru Road, located in the south-west of Melville Island. Following the January 2021 fieldwork, four additional areas were identified adjacent to Paru Road that are potentially suitable for gravel extraction. These four gravel pits were the focus of the October 2021 surveys, as displayed in Figure 1.



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Base Data: Esri, DigitalGlobe
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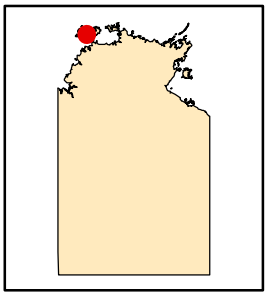
- Paru Road Proposed Alignment
- Tiwi Communities
- Project Area
- Gravel Pit Areas



Location of the project area and gravel pit locations

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CREATED BY	david.vandenhoek
LAST MODIFIED	23-Nov-2021
VERSION	1

Figure 1

A4 size

2.0 Terrestrial Ecosystems

2.1 Monsoon and Riparian Rainforest Assessment

Preliminary field planning before the January 2021 field survey identified the potential for monsoon rainforest to occur within the creek road alignment and therefore providing suitable habitat for four threatened flora species potentially occurring within the project area, in particular the Creek Road Alignment (AECOM 2021). Potential threatened monsoon vine forest flora species comprised :

- *Mitrella tiwiensis* (Vulnerable - EPBC and TPWC Act)
- *Garcinia warrenii* (Endangered - TPWC Act)
- *Luisia corrugata* (Vulnerable - TPWC Act)
- *Tarennoidea wallichii* (Endangered - TPWC Act)

Vegetation communities and supported habitats within the project area were mapped during the January 2021 field survey. Results of the survey found that the vegetation community adjacent to Paru Creek (located within the Creek Road Alignment) was a riparian vegetation community, not a monsoon forest. Dominant canopy species comprised *Melaleuca leucadendra*, *Acacia auriculiformis* and *Lophostemon lactifluus*, over *Pandanus spiralis* and *Livistona humilis*. Adjacent vegetation communities were described as Mixed spp. woodland on slopes and rises and *Eucalyptus oligantha* and *Erythrophleum chlorostachys* open forest on slopes and rises. Ground-truthed vegetation descriptions for the entire project area are provided within Table 2 and a map outlining vegetation boundaries in the northern project area is provided in Figure 2 and the southern project area in Figure 3.

Given that suitable monsoon vine forest habitat was not identified within the project area, targeted surveys for threatened monsoon forest species were not undertaken. These species were searched for during the targeted *Typhonium* spp. survey. Typhonium survey transects were placed 17 m apart and covered all potential road alignment options within the Creek Road Alignment. Typhonium surveys were led by David Liddle, an experienced field botanist with extensive experience undertaking targeted threatened flora surveys on the Tiwi Islands. No threatened monsoon forest flora species were recorded and suitable habitat for these species was not detected.

Table 2 Ground-truthed vegetation communities mapped within the project area

Unit Code	Habitat Description	Land Type	Vegetation Community	Area and % of project area
1a	*Corymbia nesophila, Eucalyptus tetrodonta, E. miniata* open forest on undulating rises	Undulating rises	*Corymbia nesophila, Eucalyptus tetrodonta, Eucalyptus miniata* mid high open forest over *Erythrophleum chlorostachys, Grevillea decurrens, Terminalia ferdinandiana* mid high open shrubland over *Sorghum plumosum, Chrysopogon latifolius, Eulalia mackinlayi* mid high tussock grassland	312.8ha (81.5%)
2a	Monsoon vine forest in gully	Gully	*Acacia auriculiformis*, *Canarium australianum*, *Terminalia microcarpa* mid high open forest over *Clerodendrum tomentosum*, *Alphitonia excelsa*, *Pandanus spiralis* mid high open shrubland over *Curcuma australasica*, *Dioscorea bulbifera*, *Ampelocissus acetosa* mid high open forbland	1.8ha (0.5%)

Unit Code	Habitat Description	Land Type	Vegetation Community	Area and % of project area
2b	Mixed spp. woodland on slopes and rises	Slopes and rises	*Erythrophleum chlorostachys*, *Corymbia bella*, *Acacia auriculiformis* mid high woodland over *Terminalia ferdinandiana*, *Petalostigma pubescens*, *Lophostemon lactifluus* mid high open shrubland over *Mnesithea rottboellioides*, *Alloteropsis semialata*, *Chrysopogon latifolius* mid high tussock grassland	20.3ha (5.3%)
2c	*Eucalyptus oligantha, Erythrophleum chlorostachys* open forest on slopes and rises	Slopes and rises	*Eucalyptus oligantha*, *Erythrophleum chlorostachys*, mid high open forest over *Planchonia careya*, *Acacia lamprocarpa*, *Terminalia ferdinandiana*, mid high open shrubland over *Chrysopogon latifolius*, *Mnesithea rottboellioides*, *Ampelocissus acetosa* mid high tussock grassland	2.8ha (0.7%)
3a	Riparian in creek line	Creek line	*Melaleuca leucadendra*, *Acacia auriculiformis*, *Lophostemon lactifluus* mid high open forest over *Pandanus spiralis*, *Litsea glutinosa*, *Livistona humilis* mid high open shrubland over *Mnesithea rottboellioides*, *Chrysopogon latifolius*, *Ampelocissus acetosa* mid high tussock grassland	4.3ha (1.1%)
4a	*Melaleuca viridiflora, Grevillea pteridifolia* woodland on perched drainage	Perched drainage	*Melaleuca viridiflora*, *Grevillea pteridifolia*, ± *Eucalyptus tetrodonta* mid high open woodland ± isolated trees over *Petalostigma pubescens*, *Melaleuca viridiflora*, *Verticordia cunninghamii* mid high shrubland over *Eriachne avenacea*, *Schoenus sparteus*, *Sorghum plumosum* mid high open tussock grassland	16.7ha (4.4%)
4b	*Erythrophleum chlorostachys* woodland on upland drainage	Upland drainage	*Erythrophleum chlorostachys* mid high woodland over *Terminalia ferdinandiana*, *Melaleuca viridiflora*, *Corymbia foelscheana* mid high shrubland over *Mnesithea rottboellioides*, *Planchonia careya* mid high tussock grassland	9.5ha (2.5%)
4c	*Corymbia nesophila, Erythrophleum chlorostachys* woodland on low drainage slope	Low drainage slope	*Corymbia nesophila*, *Erythrophleum chlorostachys* mid high woodland over *Erythrophleum chlorostachys*, *Pandanus spiralis*, *Melaleuca viridiflora* mid high open shrubland over *Sorghum plumosum*, *Planchonia careya*, *Melaleuca viridiflora* mid high tussock grassland	4.5ha (1.2%)

Unit Code	Habitat Description	Land Type	Vegetation Community	Area and % of project area
4d	*Erythrophleum chlorostachys, Corymbia polycarpa* open woodland on low broad drainage	Low broad drainage	*Erythrophleum chlorostachys*, *Corymbia polycarpa*, *Acacia auriculiformis* mid high open woodland over *Melaleuca viridiflora*, *Grevillea pteridifolia*, *Petalostigma pubescens* mid high shrubland over *Sorghum plumosum*, *Thaumastochloa major*, *Spermacoce stenophylla*	9.7ha (2.5%)

2.2 Weed management

TLC Environment Officer Murray Knyvett has indicated that the focus of weed management is to prevent the introduction of weeds onto the Tiwi Islands. Murray is currently liaising with the construction contractor Tiwi Partners, and is undertaking inspections of equipment office prior it being mobilised onto the islands. The focus is on removing all soil and loose vegetation from plant and equipment. All equipment is required to be certified as weed-free prior to mobilisation.

Murray has also communicated with Tiwi Partners the requirement to check plant and equipment sourced on the Tiwi Island prior to it being mobilised to the Paru Road project area. Perrenial Mission Grass (*Cenchrus polystachios*) and Snakeweed (*Stachytarpheta* spp.) are prevalent in communities on the Tiwi islands and measures are required to prevent their spread onto Paru Road.

Weeds have not been detected within the project area during surveys. Weed management measures to be implemented within the project area include:

- monitor project disturbance areas for weeds
- early detection of weed incursions
- early eradication of weeds through targeted control
- ongoing monitoring of weed incursion sites and follow up targeted control

Given the current weed free status of the project area and management approach outlined above, it is unlikely that weed control will result in significant impacts to non-target plants, including threatened *Typhonium* spp. populations.

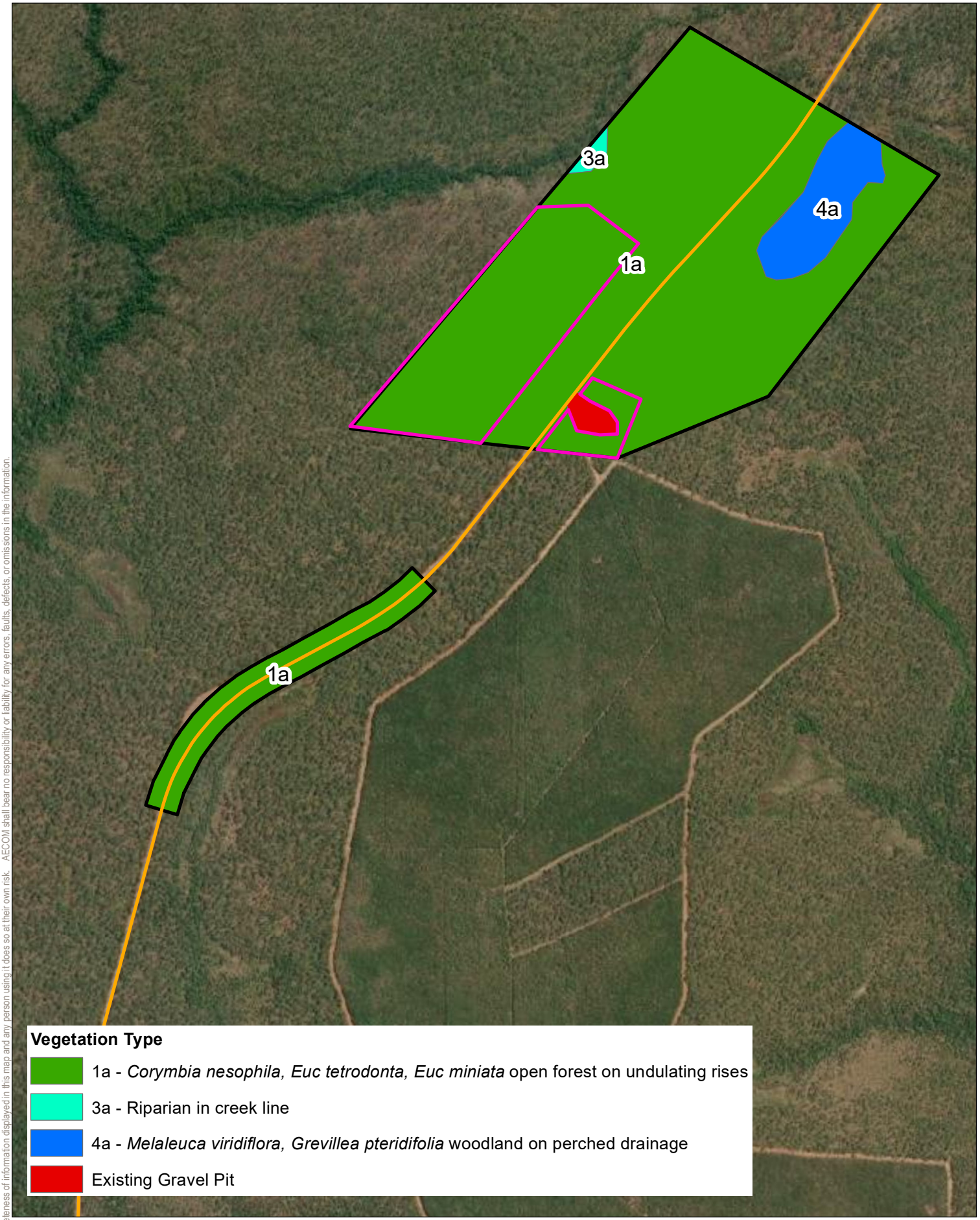
Additional information on the Tiwi Land Council's weed management policy can be found on the following website:

https://tiwilandcouncil.com/index.cfm?fuseaction=page&p=299&l=2&id=64&smid=209

The Tiwi Land Council Weed Management Plan (2017-2018) can be found here:

https://tiwilandcouncil.com/documents/Uploads/Tiwi%20Islands%20Weed%20Management%202017-18.pdf

The Weed Management Program to be implemented for the project is outlined in Appendix B.



Vegetation Type

- 1a - *Corymbia nesophila, Euc tetrodonta, Euc miniata* open forest on undulating rises
- 3a - Riparian in creek line
- 4a - *Melaleuca viridiflora, Grevillea pteridifolia* woodland on perched drainage
- Existing Gravel Pit

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Kilometres

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- Paru Road Proposed Alignment
- Gravel Pit Areas
- Project Area

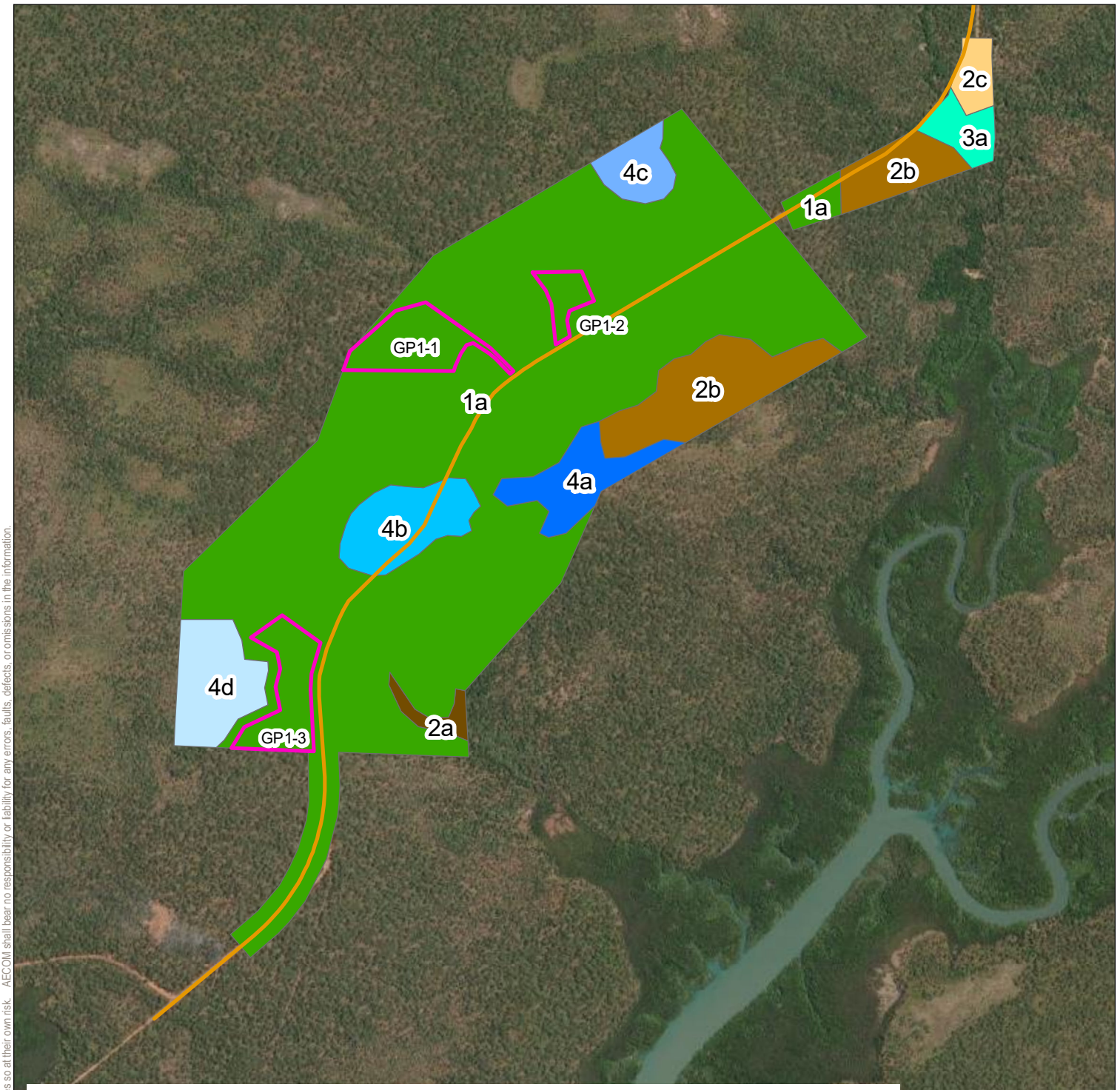
Ground-truthed vegetation map of the northern project area

PROJECT ID	60571058
CREATED BY	david.vandenhoek
LAST MODIFIED	23-Nov-2021
VERSION	1

Figure 2

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 2. Ground-truthed vegetation map North.mxd

A4 size



Vegetation Type

- 1a - *Corymbia nesophila, Euc tetrodonta, Euc miniata* open forest on undulating rises
- 2a - Monsoon vine forest in gully
- 2b - Mixed spp. woodland on slopes and rises
- 2c - *Eucalyptus oligantha, Erythrophleum chlorostachys* open forest on slopes and rises
- 3a - Riparian in creek line
- 4a - *Melaleuca viridiflora, Grevillea pteridifolia* woodland on perched drainage
- 4b - *Erythrophleum chlorostachys* woodland on upland drainage
- 4c - *Corymbia nesophila, Erythrophleum chlorostachys* woodland on low drainage slope
- 4d - *Erythrophleum chlorostachys, Corymbia polycarpa* open woodland on low broad drainage

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DATUM GDA 1994, PROJECTION MGA ZONE 52

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Kilometres

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- Paru Road Proposed Alignment
- Project Area
- Gravel Pit Areas

Ground-truthed vegetation map of the southern project area

PROJECT ID	60571058
CREATED BY	david.vandenhoek
LAST MODIFIED	23-Nov-2021
VERSION	1

Figure 3

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 3. Ground-truthed vegetation map South.mxd

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3.0 Terrestrial Ecology Surveys

Three qualified AECOM staff undertook terrestrial ecology surveys during 4 – 11 October 2021. Tiwi ranger Warrick Puruntatameri assisted the field surveys for three days.

3.1 Threatened Mammal Survey

Prior to the survey, the methodology for Butler's Dunnart (*Sminthopsis butleri*) and Pale Field Rat (*Rattus tunneyi*) was agreed with the Flora and Fauna Division of the NT Department of Environment, Parks and Water Security. The agreed methods aim to determine the presence or absence of Butler's Dunnart and Pale Field Rat within the proposed gravel pit sites. Pitfall traps were established to target Butlers Dunnart and Elliot traps targeted Pale Field-Rat. Motion-activated cameras were established to target both species.

Trapping for this survey was undertaken under NT Animal Research License number 078 (Project number A17019), as approved by the Charles Darwin University Animal Ethics Committee.

Traps were set up as follows:

- Pitfall taps set in lines of 2-4, approximately 10 m apart, with a 20-40 m long x 30 cm high drift fence along the length of the line, across the top of all the pits
- Elliot traps set in linear lines of five traps approximately 50 m long
- Motion-activated cameras with 4 m drift fences on either side of a bait station

Trap set-up in each gravel pit details are provided below in Table 3, and displayed in Figure 4 and Figure 5.

Table 3 Trap set-up

Gravel Pit	Pitfall Traps	Elliot Traps	Cameras
GP2-1 & GP2-2	20 pitfall traps • 5 x 40 m drift lines with 4 pits per line	60 Elliot traps • deployed in 12 x 50 m linear lines	8 cameras
GP1-1	10 pitfall traps • 2 x 30 m lines of 3 pits • 2 x 20 m lines of 2 pits	20 Elliot traps • 4 x 50 m linear lines	6 cameras
GP1-2	6 pitfall traps • 2 x 30 m lines with 3 pits per line	20 Elliot traps • 4 x 50 m linear lines	2 cameras
GP1-3	9 pitfall traps • 1 x 30 m line of 3 pits • 3 x 20 m lines of 2 pits	20 Elliot traps • 4 x 50 m linear lines	6 cameras

Pitfall traps were established during the first four days of the survey (4 – 7 October 2021). Once installed, pitfall traps were left in place until the last day of the survey on 11 October. A pitfall trap line was removed once a Butler's Dunnart was detected because the aim of determining the species presence had been achieved, and additional trapping effort was not required.

Details of pitfall traps set up in each gravel pit are outlined in Table 4.

Table 4 Pitfall traps

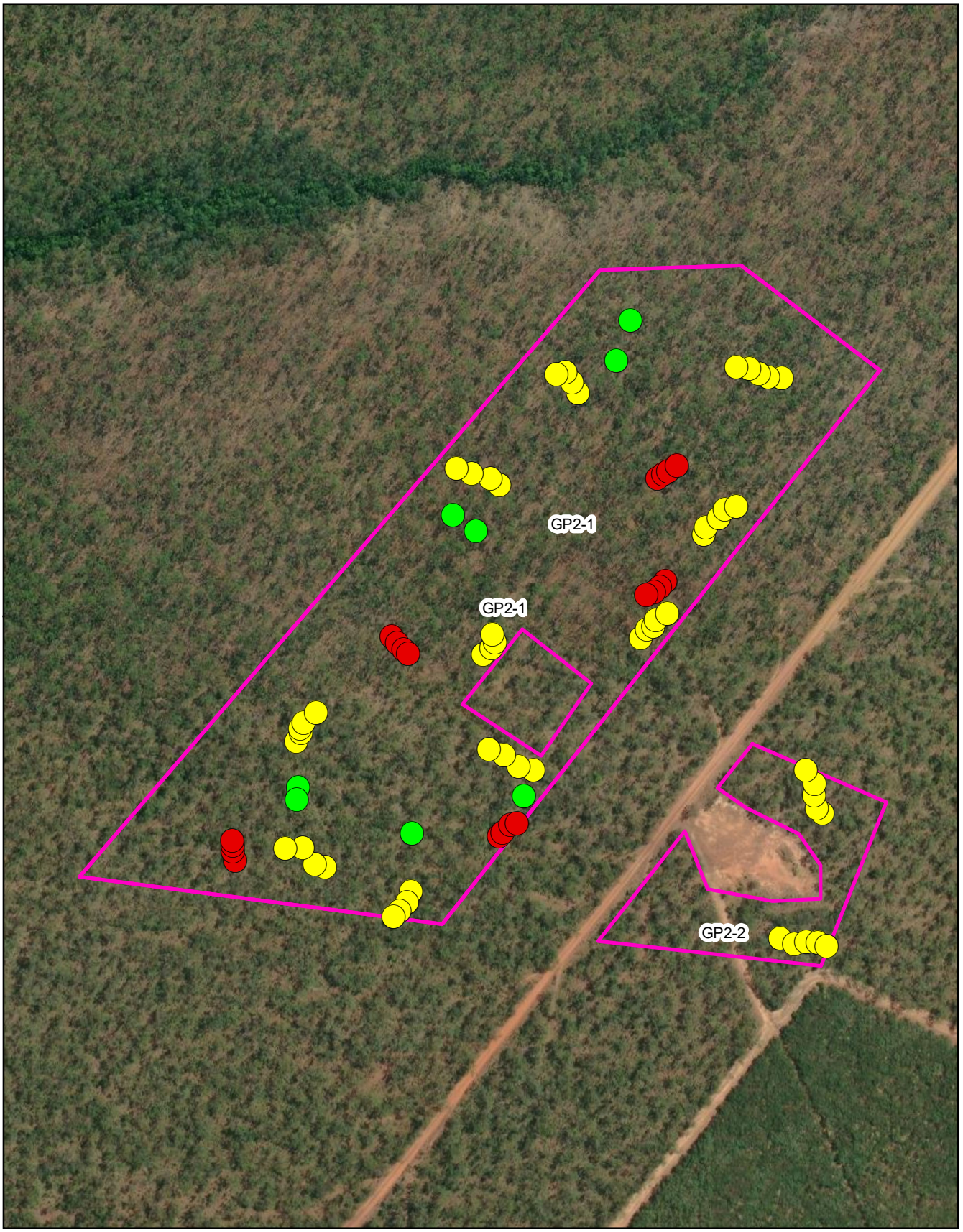
Gravel Pit	Pitfall line	Number of pitfall traps	Number of nights set up
GP2-1	Pitfall line 1	4	7
	Pitfall line 2	4	2*
	Pitfall line 3	4	7

Gravel Pit	Pitfall line	Number of pitfall traps	Number of nights set up
	Pitfall line 4	4	1*
	Pitfall line 5	4	6
GP1-1	Pitfall line 1	2	6
	Pitfall line 2	3	6
	Pitfall line 3	3	5
	Pitfall line 4	2	5
GP1-2	Pitfall line 1	3	6
	Pitfall line 2	3	3*
GP1-3	Pitfall line 1	3	5
	Pitfall line 2	2	4
	Pitfall line 3	2	4
	Pitfall line 4	2	2*

*Trapping ceased after a Butler's Dunnart was detected

Elliot traps were set up for a period of three nights per trap.

Motion-activated cameras were installed during 7 – 11 October 2021. The cameras were active for a period of one month and were retrieved from Paru Road on 11 November 2021.



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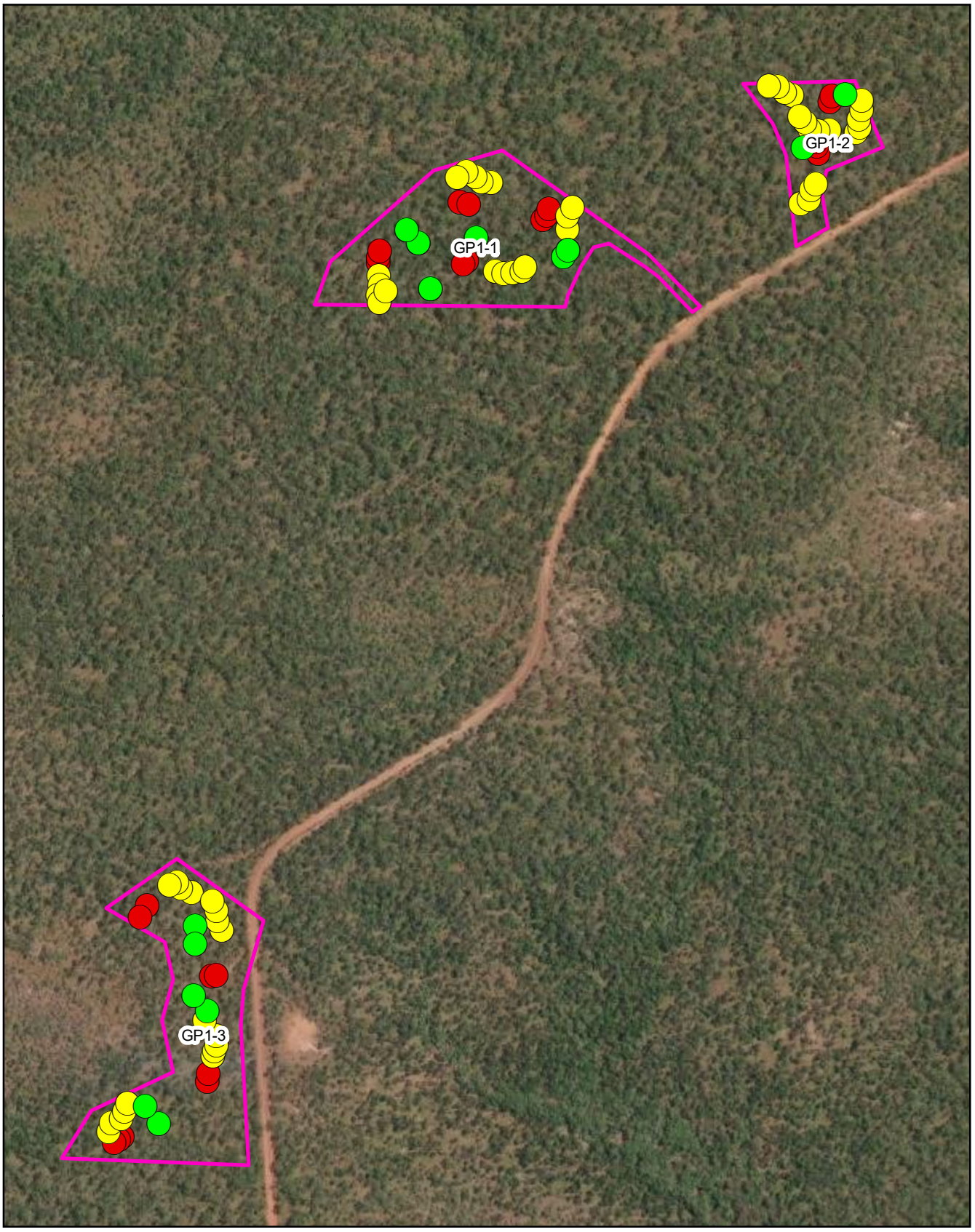
- Cameras
- Elliots
- Pitfall
- Gravel Pit Areas

Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL
Threatened Mammal Trapping Locations in the Northern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 4

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 4. Traps Northern Project.mxd



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AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 52

0 205 410
metres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
AECOM Australia and Esri do no warrent the accuracy or completeness of information in this publication and any person relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

- Cameras
- Elliots
- Pitfall
- Gravel Pit Areas

Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL

Habitat Tree Numbers Recorded within the Southern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 5

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 5. Traps Southern Project.mxd

3.1.1 Results

Data were retrieved from 21 of the 22 cameras installed in the four proposed gravel pits. Several cameras were chewed by wildlife (most likely Black-footed Tree-rat *Mesembriomys gouldii*) and the SD card was destroyed on one camera in GP 2-1 (11.688964°, 130.685191°).

Butler's Dunnart

A total of 11 Butler's Dunnarts were detected during the survey across 10 locations, with two dunnarts detected along one pitfall line in GP 1-3. Six dunnarts were caught in pitfall traps and five were recorded on motion-activated cameras. Locations where Butler's Dunnart individuals were detected are provided in Table 5 below and mapped in Figure 6 and Figure 7.

Table 5 Butler's Dunnart location and method of detection

Gravel Pit	Detection method	Location (latitude, longitude)	Reference
GP 2-1	Pitfall	11.692133°, 130.685719°	Plate 2
	Pitfall	11.689672°, 130.687289°	Plate 3
	Camera	11.688964°, 130.685191°	Plate 4
	Camera	11.687413°, 130.686834°	Plate 5
GP 1-1	Camera	11.725806°, 130.656207°	Plate 6
	Camera	11.725640°, 130.656055°	Plate 7
GP 1-2	Pitfall	11.724603°, 130.661532°	Plate 8
	Pitfall	11.723842°, 130.661703°	Plate 9
GP 1-3	Pitfall	11.734684°, 130.652555°	Plate 10 & Plate 11
	Camera	11.737164°, 130.652639°	Plate 12

Photos of Butler's Dunnart detected during the survey are displayed in Appendix C.

Pale Field-rat

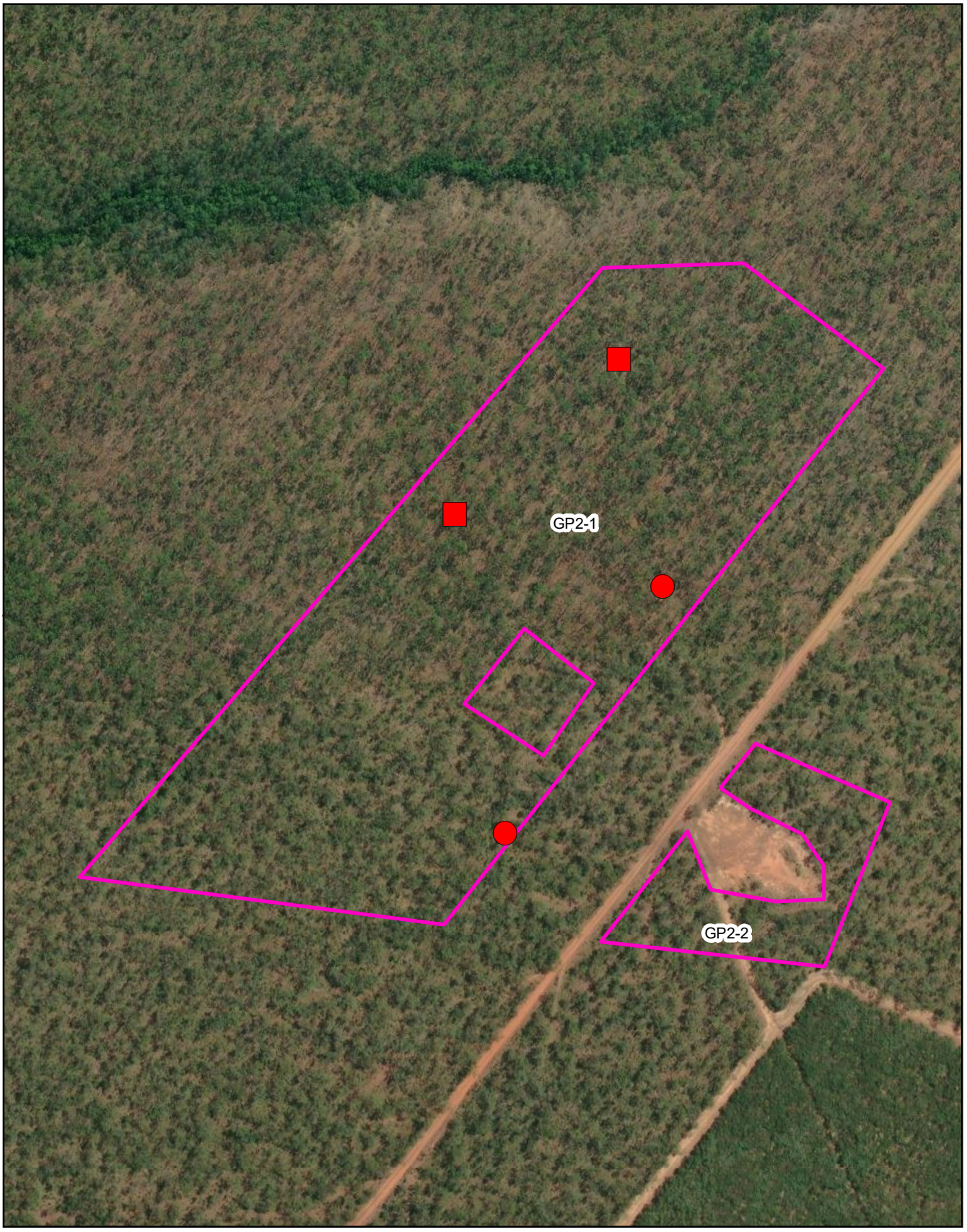
A total of three Pale Field-rats were detected during the survey. Uncertainty exists regarding the identification of the mammal recorded at GP 1-1 (Plate 13), due to the head being obscured in the photo. The tail appears to be too short to be a Pale Field-rat; however, the angle at which the tail is pointed may cause the tail to appear smaller than in reality. The size and shape of the mammal in the photo suggests that it is most likely a Pale Field-rat.

Locations where Pale Field-rat individuals were detected are outlined in Table 4 and displayed in Figure 6 and Figure 7.

Table 6 Pale Field-rat location and method of detection

Gravel Pit	Detection method	Location	Reference
GP 1-1	Camera	11.723822°, 130.661885°	Plate 13
GP 1-2	Camera	11.725640°, 130.656055°	Plate 14
	Camera	11.725892°, 130.658202°	Plate 15

Photos of Pale Field-rats detected during the survey are displayed in Appendix C.



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AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 52

0 160 320
metres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
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Threatened Species & Trap Type

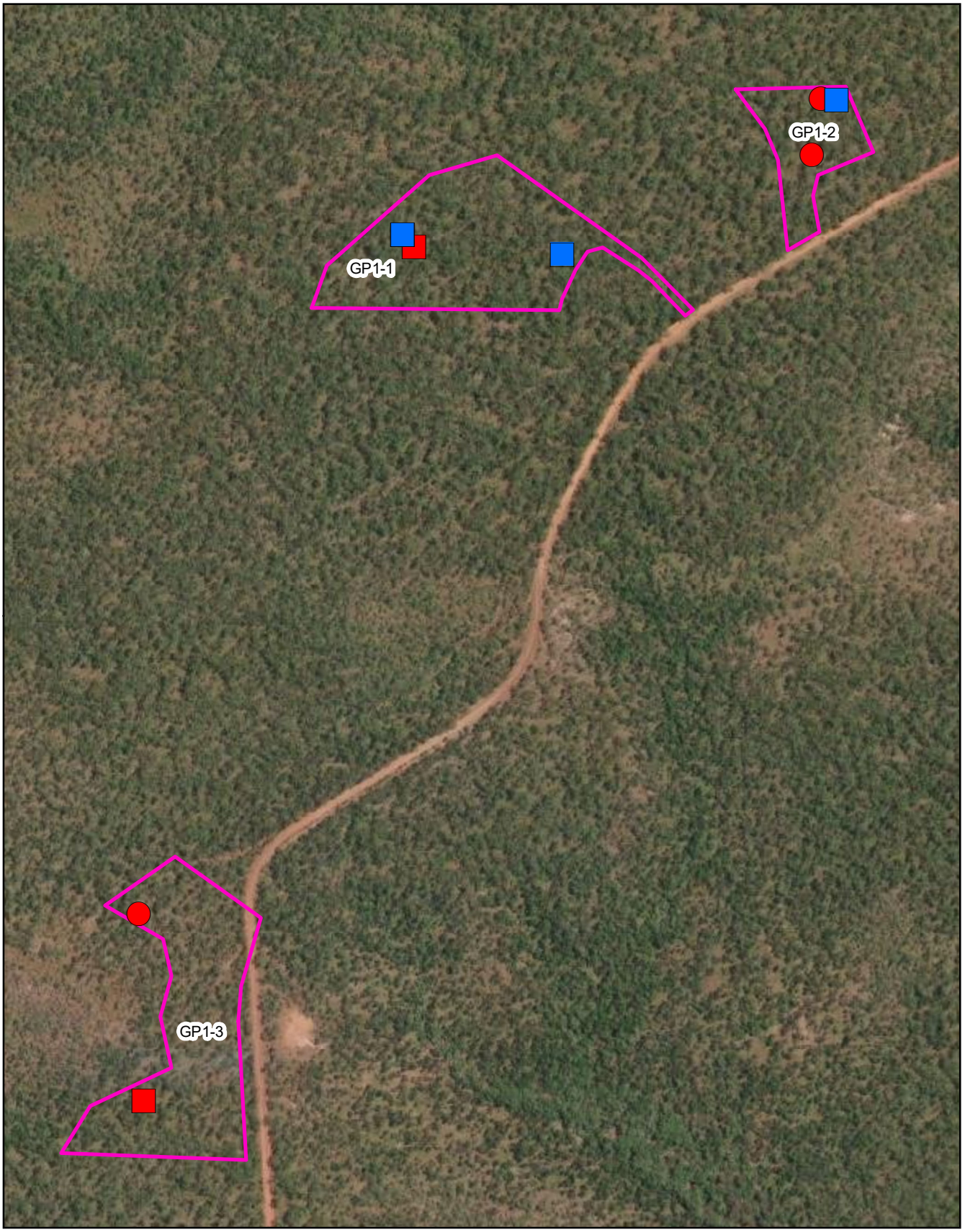
- Butlers Dunart, Camera
- Butlers Dunart, Pitfall
- Gravel Pit Areas

Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL
Threatened Mammal Detected in the Northern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 6

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 6. Mammals Northern Project.mxd



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AECOM
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DATUM GDA 1994, PROJECTION MGA ZONE 52

0 205 410
metres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
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Threatened Species & Trap Type

- Butlers Dunart, Camera
- Butlers Dunart, Pitfall
- Pale Field Rat, Camera
- Gravel Pit Areas

Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL

Threatened Mammals Detected in the Southern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 7

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 7. Mammals Southern Project.mxd

3.1.2 Discussion

Both Butler's Dunnart and Pale Field-rat were detected during the October 2021 survey. Butler's Dunnarts was detected at four of the proposed gravel pits while Pale Field-rat was detected at two gravel pits.

The surveys was designed to determine the presence or absence of threatened mammals within the proposed gravel pits. Survey design was not optimal for quantifying the abundance of Butler's Dunnart or Pale Field-rat within the project areas; however results indicate that both species are present within the proposed gravel pits. Both species were detected during surveys undertaken adjacent to Paru Road in January 2021.

The proposed gravel pits where surveys were undertaken are within the favoured Butler's Dunnart habitat of eucalypt open forest and woodland dominated by *Eucalyptus miniata*, *E. tetrodonta* and *Corymbia nesophila*. Vegetation mapping indicates that this is the dominant habitat adjacent to Paru Road. Survey results indicate that the species is not rare on Melville Island and would almost certainly occur within woodland habitats adjacent to the proposed gravel pits.

Pale-field Rat is less common than Butler's Dunnart within the proposed gravel pits. The species occurs across a wide range of habitats and is likely more common in riparian areas on Melville Island than within eucalypt open forests where the survey was undertaken.

Finding a suitable area adjacent to Paru road for gravel extraction that avoids impacts to Butler's Dunnart and Pale Field-rat may not be possible, as both species are reasonably common. The proposed gravel pits represent a small portion of suitable habitat available to both species on Melville Island. Gravel extraction would not result in a significant impact to the populations of either species on Melville Island.

3.2 Assessment of Large Tree Density

3.2.1 Method

A survey was conducted to record the density of large trees with a diameter at breast height (DBH) between 40-49 cm and very large trees (>50 cm DBH), located both inside and outside areas of impact (proposed gravel pits) within the project area. The survey was designed in consultation with the Flora and Fauna Division of the NT Department of Environment, Parks and Water Security, to identify if the proposed development would impact the availability of high-value habitat trees.

Mapping during the 2021 survey identified that proposed gravel pit areas all comprised *Corymbia nesophila*, *Eucalyptus tetrodonta*, *E. miniata* open forest on undulating rises. This vegetation type encompassed the majority of the project area (81.5%) and was therefore targeted for the comparative surveys carried out outside the proposed sites.

A total of 30 survey points were established within the proposed gravel-pits and 30 surveys points were established just outside. Survey points were randomly located, with the number of points distributed proportionally across target areas. A 40 m radius assessment area (0.5 ha) was applied to each survey point and field maps were produced in ArcGIS and uploaded to a handheld GPS unit for reference in the field. Survey point boundaries were assessed in the field with a GPS. Large and very large trees were counted at each survey site.

3.2.2 Results

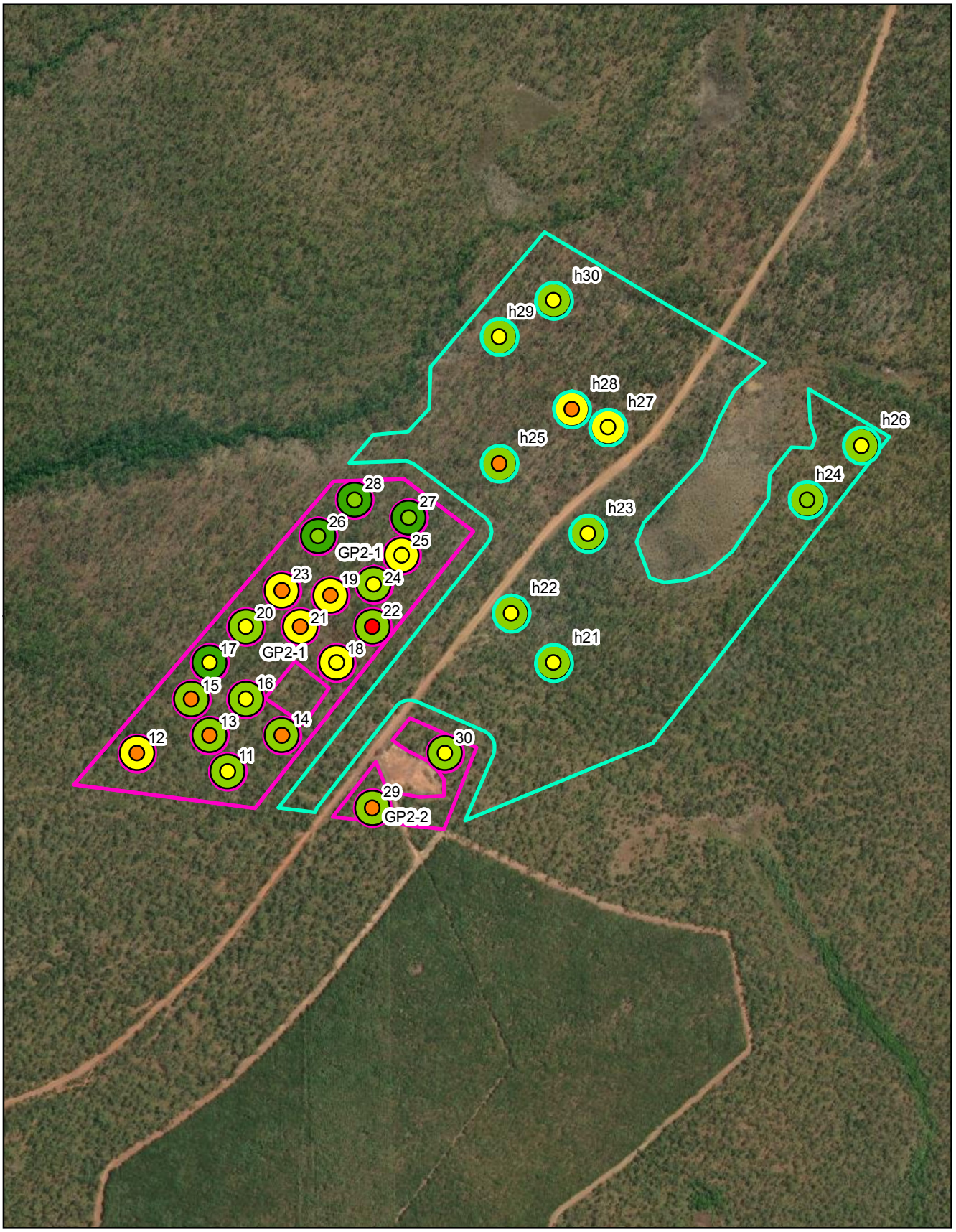
The large tree and very large habitat tree counts recorded during the survey were analysed according to a chi-squared test to determine if there was a statistically significant difference between the number of large and very large habitat trees inside and outside the proposed gravel pit areas. The results of the survey and chi-squared test are shown below Table 7. While there was a greater number of habitat trees recorded inside the proposed gravel pits compared to outside, the number was not found to be significantly different according to the chi-squared test. A map showing the range of large and very large trees recorded within the northern survey area is provided in Figure 8 and Figure 9 for the southern survey area. Habitat tree counts within the survey area are provided in Appendix D.

Table 7 Tree counts inside and outside of proposed gravel pits

Variable	Large trees (40-49cm DBH)	Very large trees (>50cm DBH)
Inside Gravel Pits		
Total number of trees	178	78
Count range	(1 - 13)	(0 - 6)
Outside Gravel Pits		
Total number of trees	165	78
Count range	(1 - 10)	(0 - 8)
Chi-squared Test		
P value	0.48272	No difference in value
Test statistic	0.492711	
Critical value	3.841459	
Significance	Not significant	Not significant

3.2.3 Conclusion

Assessment of large and very large trees determined that there is no discernible difference between the density of these trees inside the areas of impact (proposed gravel pits) and outside the areas of impact. The removal of large trees to develop gravel pits will have a local impact to threatened species that depend on tree hollows; however, these impacts will not be significant due to the abundance of large trees outside of the areas of impact.



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DATUM GDA 1994, PROJECTION MGA ZONE 52

0 320 640

metres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
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Tree Size

- Large Trees 40cm -50cm
- Very Large Trees >50cm

- Gravel Pit Areas
- Habitat Outside Gravel Pits

Number of Trees

- 0
- 1-3
- 4-6
- 7-9
- 10-13

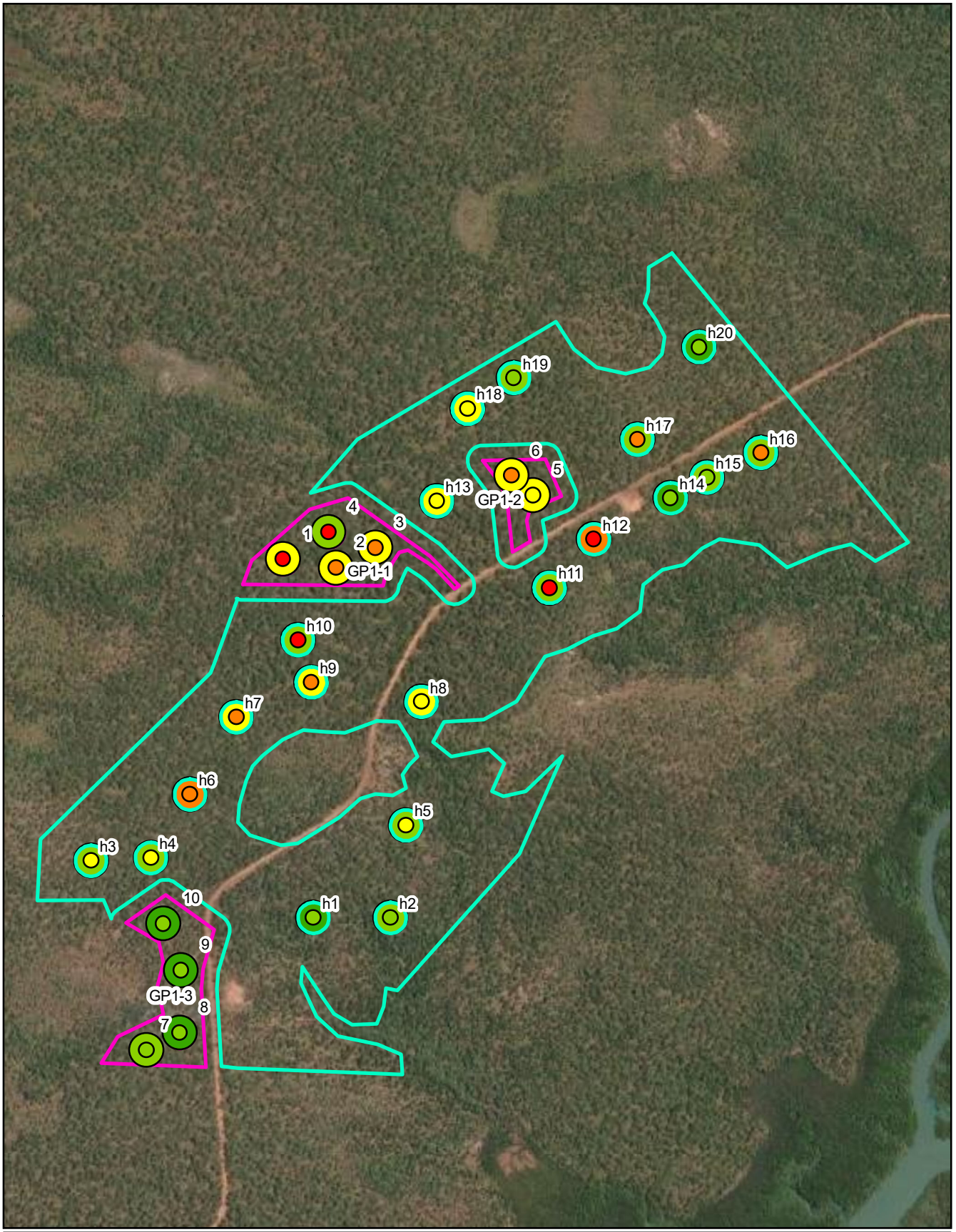
Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL

Habitat Tree Numbers Recorded within the Northern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 8

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 8. Habitat Trees Northern Project.mxd



AECOM

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N

DATUM GDA 1994, PROJECTION MGA ZONE 52

0 360 720

metres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
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Tree Size

- Large Trees 40cm -50cm
- Very Large Trees >50cm

Number of Trees

- 0
- 1-3
- 4-6
- 7-9
- 10-13

- Gravel Pit Areas
- Habitat Outside Gravel Pits

Paru Road Threatened Species Significance of Impact Assessment
Client: DIPL

Habitat Tree Numbers Recorded within the Southern Project Area

PROJECT ID	42627514
CREATED BY	david.vandenhoek
LAST MODIFIED	10-Dec-2021
VERSION	A

Map 9

Filename: L:\Legacy\Projects\606x\60626775\900_CAD_GIS\920_GIS\02_MXDs\Habitat survey September 2021\Report Maps\Figure 9. Habitat Trees Southern Project.mxd

4.0 Hydrological Processes, Inland Water Environmental Quality and Aquatic Ecosystem

4.1 Water Abstraction and Sources

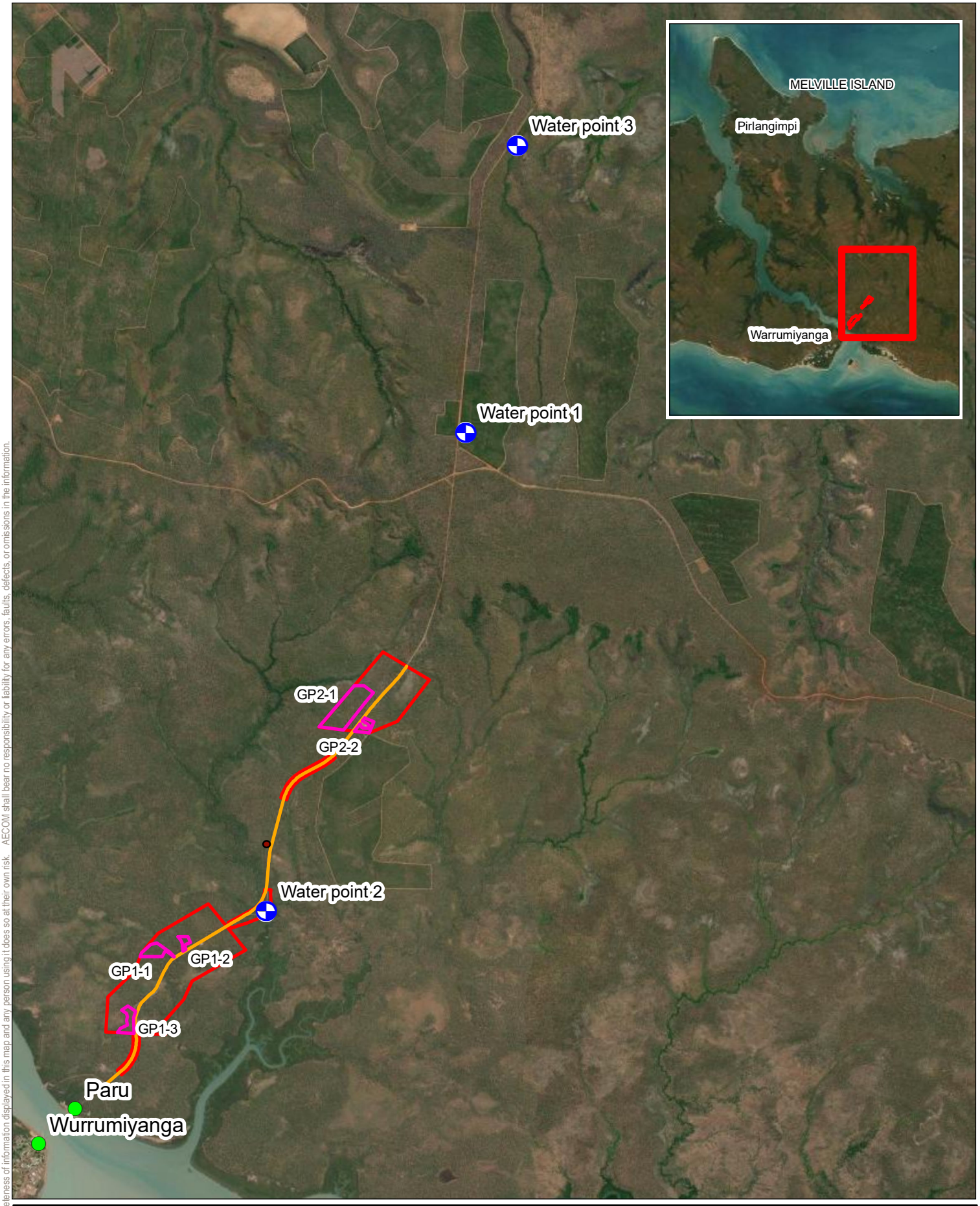
Three potential freshwater water points for works will be nominated. All water extraction is to occur in accordance with the relevant AAPA Certificate and current TLC Permit. These water sources have been approved by TLC previously. Water source locations are displayed in Figure 10 and described in Table 8.

Table 8 Water source locations

Location / description	Chainage	Location (latitude, longitude)	Tenure	AAPA Certificate
Water Point 1 Bore RN008433 & RN008437 owned by Plantation Management Partners	Approximately 730 m north of the Three Ways intersection	130.703109°, -11.649135°	NT Portion 1644 Tiwi ALT	C2016/124
Water Point 2 Paru creek	Approximate Ch 8.3km south along Paru Road	130.673714°, -11.719994°	NT Portion 1644 Tiwi ALT	C2016/121
Water Point 3 Taracumbi Creek	Approximate Ch 5.7km north of the Three Ways intersection	130.710599°, -11.606748°	NT Portion 1644 Tiwi ALT	C2020/014

A Water Supply Investigation was undertaken by Territory Groundwater Services Pty Ltd in 2019. The investigation recommended the above water sources. A copy of the Territory Groundwater Services report is supplied in Appendix E.

It is expected that approximately 200 kL / day of water will be required for the road works. It is estimated that the earthworks and pavement works will take approximately 6 months per year, which equates to approximately 36 ML of water. When considering spillage and dust suppression, this volume can potentially increase.



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AECOM
www.aecom.com

DATUM GDA 1994, PROJECTION MGA ZONE 52

0 0.5 1 2 3
Kilometres

Data sources:
Base Data: Esri, DigitalGlobe
Field data: AECOM Australia
AECOM Australia and Esri do no warrent the accuracy or completeness of information in this publication and any person relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

- Water Sources
- Tiwi Communities
- Paru Road Proposed Alignment
- Project Area
- Gravel Pit Areas

Paru Road
Nominated Water Sources
Location Map

PROJECT ID	60571058
CREATED BY	david.vandenhoek
LAST MODIFIED	01-Feb-2022
VERSION	1

Figure 10

A4 size

4.2 Maintenance of Natural Flow Regimes

The road has been designed to incorporate culverts and other drainage means to avoid changing the upstream and downstream flow regimes as much as practical. The culverts have been strategically designed to reduce upstream ponding and to ensure the connectivity of watercourses.

The majority of the road follows the existing alignment. With the upgrade works, the road will be lifted and cross fall maintained to ensure drainage of the road surface, as well as table drains and offlet drains constructed to ensure that runoff water is directed away from the road. There are eleven transverse drainage structures (culverts) to be constructed along Paru Road.

The Paru Creek crossing will be relocated, with crossing options that have been presented to the Tiwi island regional Council (TIRC) and the Tiwi Land Council (TLC). DIPL is currently working with TIRC and TLC to facilitate a response regarding their decision on which option (Option 1 – Bridge (single span), Option 2 – Reinforced Concrete Box Culverts, and Option 3 – Reinforced Concrete Pipes). All options have been engineered to prevent 'back-up' of flows outside of natural processes based on the catchment area and anticipated volumes.

The construction works are aimed to be undertaken in the Dry season (April to October). The Contractor will be required to develop and implement an approved Erosion and Sediment Control Plan (ESCP) irrespective of the timing of works.

4.3 Creek Crossing Impacts and Mitigation Measures

Three crossing options have been presented to TIRC and TLC:

- Option 1 – Bridge (single span)
- Option 2 – 2100 mm x 2100 mm Reinforced Concrete Box Culverts
- Option 3 – 2100 mm diameter. Reinforced Concrete Pipes

The options were presented to TIRC and TLC via a Summary of Concept Design Options containing pros and cons, including 3D visualisations.

On 7 December 2021, TIRC provided formal confirmation on their decision to proceed with the Bridge option. As per the Summary of Concept Design Options, this option presents less impact to the environment compared to the other options because it is intended to be a single span bridge, therefore no pier construction within waterway. This reduces environmental impact and reduces restriction to water flow during construction works and afterwards.

The concept design visual for the Bridge option is displayed below in Plate 1.

The impacts of a changing climate are not expected to affect the road works and bridge works as the works are anticipated to be completed within a two-year period. The bridge will be designed with a minimum 0.11 exceedance per year (EY) storm event requirement. Based on *Australian Rainfall and Runoff guidelines* (Geoscience Australia 2019), 0.11EY is equal to a 1 in 10 Year annual exceedance probability (AEP) event.

The existing single lane crossing on Paru Road is located on a sharp bend which creates safety concerns, and the infrastructure has severely deteriorated. The construction of the two-lane bridge and upgrade of the roads will provide a significant improvement to the existing road conditions along Paru Road. This includes improved flood immunity, road safety, visibility and sightlines for drivers, road capacity and drainage.

Plate 1 Concept design visual for bridge crossing

It is intended that to the greatest extent practical, construction and operation of the Crossing will minimise direct impacts to the creek. This includes undertaking the works in the dry season when the extent of flow is limited. Where drainage lines are impacted directly, the impact will be minimised with temporary controls such as using pumps or constructing channels. An ESCP developed by a certified professional assessed by DIPL and implemented on site will be a requirement of the contracting tender. Controls required by the ESCP may include silt fences, coir logs and/or earth berms around the upper areas of construction, rock check dams and/or filter dams along drains and areas of concentrated flow, use of geofabric to line drains or cover exposed areas during severe rainfall events, no stockpiling within 50 m of streams and stopping construction works in the creek line during rain events.

The Contractor will also be required to comply with NT Government Standard Specification for Environmental Management which specify the minimum requirements for Water Quality and Surface Water Management.

4.4 North Road Realignment and Associated Impacts to Drainage Lines

The refined gravel pit extraction areas have been located within the overall gravel pit survey area and include buffers to drainage features and ephemeral streams. These have been ground-truthed by AECOM and NT Land Clearing Guidelines buffers have been applied to reduce risk of impacts associated with clearing and extraction.

The Contractor will be required to comply with NT Government Standard Specification for Environmental Management which specifies the minimum requirements for Materials Extraction. This clause outlines the limit of excavations such as:

- Not within 25 m of a watercourse (refer to Northern Territory Land Clearing Guidelines for watercourse buffers (DEPWS, 2021))
- Not within 200 m of a defined waterway crossing
- Not within vegetative buffers etc.

The Contractor will also be required to develop a Gravel Pit Management Plan.

4.5 Impacts to Aquatic Habitats

The creek that crosses Paru Road is small and classified as a major non-perennial stream on NT Resource Maps.

An ESCP will be a requirement of the tender to be developed by a certified professional in erosion and sediment control, assessed by DIPL and implemented on site. Controls on site may include but not be limited to silt fences, coir logs and/or earth berms around the upper areas of construction, rock check dams and/or filter dams along drains and areas of concentrated flow, use of geofabric to line drains or cover exposed areas during severe rainfall events, no stockpiling within 50 m of streams, stopping construction works in the creek line during rain events.

Erosion and sediment control will be considered in the design of the Paru Creek crossing upgrade.

5.0 Community and Economy

5.1 Community Consultation

This project is governed by a Corridor Investment Strategy. This investment strategy provides an evidence-based approach to road transport infrastructure along the corridor for both the Australia Government and local government, from high level planning through to pre-delivery.

Stakeholder engagement and consultation was performed through meetings with major organisations and leaders on Tiwi Islands. A number of meetings were held through 2020 and 2021 in Darwin and on the islands with TLC and TIRC. A site visit was conducted in mid-2020 that enabled DIPL staff to inspect all of the roads proposed for upgrades and meet with local stakeholders including forestry industry representatives. These consultations formed the basis of this investment strategy, including identification and prioritisation of projects.

The role of the TLC is to represent Tiwi people in the protection of the natural environment while '*supporting sustainable economic development to improve Tiwi lives through employment, income, education and health opportunities*' (TLC, 2021). The role of the TIRC is to administer the two Tiwi islands, Bathurst and Melville, and the communities of Wurrumiyanga, Wurankuwu, Milikapiti and Pirlangimpi, as well as a number of smaller outstations on both islands.

DIPL's Transport and Planning Division communicates regularly with TIRC and TLC on a range of matters including the Paru Road upgrade.

DIPL delivered a presentation to the TLC in March 2021. The presentation provided an overall outlook and plan for the delivery of the Tiwi Islands $75 million program. The presentation was positively received.

DIPL also provide status updates via email to the TIRC and TLC regarding significant milestones and decisions required by TIRC and TLC, such as the Paru Creek crossing options.

Tiwi Rangers are proposed to be used in land clearing operations to confirm approval of clearing area prior to clearing being undertaken.

A mineral extraction agreement with TLC has been established providing formal approval to clear and extract from the nominated gravel pit areas and includes reimbursement for extractives to the Council.

5.2 Project Workforce

The road works intended for the Tiwi Islands will consider Indigenous participation through the Contractor for several activities for the upgrade of Paru Road. These activities include:

- Earthworks such as hauling and dumping fill material, and laying, watering, and compacting fill layers
- Pavement works such as grading, compacting, and trimming
- Drainage work such as installation of reinforced concrete box culverts and concrete works
- Protection works such as the installation of Reno mattresses and dumped rock
- Borrow pit operations and material extractions
- Servicing and maintenance of construction plant and equipment
- Work Zone 2 and 3 traffic management positions to manage traffic flow through the work sites and to and from the material and water sources
- General labour work
- Camp operations such as cooking and cleaning
- Transport of workers to and from camp and job site
- Environmental monitoring.

Of equal importance is the opportunity for on-the-job skills development and for key civil operator roles that are in high demand across the NT.

Tiwi Rangers are proposed to be utilised in any land clearing operations to confirm approval of clearing area prior to clearing being undertaken.

Tiwi Rangers have also been involved in the survey works undertaken by consultants as part of the planning and development of the referral. As well as direct employment, this has provided invaluable training and experience in the undertaking of surveys to meet guidelines and standards for flora and fauna assessments.

In the tender documentation, DIPL will be specifying minimum targets for engagement of Indigenous persons and businesses. This will align with the approved Indigenous Participation Plan that follows the Indigenous Employment and Supplier-Use Infrastructure Framework. This framework aims to increase Indigenous employment and supplier-use in the delivery of land transport infrastructure projects funded or co-funded by the Australian Government.

Minimum targets for Indigenous employment and engagement of Indigenous businesses will be determined by an Indigenous Participation Plan (IPP). The IPP, in conjunction with National Indigenous Australians Agency (NIAA), will be set in the contract documentation and monitored throughout the contract duration.

5.3 Potential Impacts to Road Users

The camp and laydown area is located on Paru Road, which means that construction traffic will be concentrated on Paru Road, rather than spread across other areas of the Island.

The works shall be planned and managed to minimise obstruction and inconvenience to the public, and ensure public safety is accommodated at all work sites at all times. During construction, access along Paru Road will remain open, although short delays may be experienced. Disruption will be minimised and safety maintained through traffic management implemented by the contractor.

Temporary traffic management will consist of temporary lane closures, temporary speed limits, portable traffic signals and stop-and-slow methods.

This Project will benefit the local communities and councils by:

- Reduction in travel times private
- Reduction in travel times commercial including forestry
- Reduction in vehicle operating costs
- Improvement in safety
- Improved flood immunity
- Reduction in closures and restrictions
- Reduced road maintenance cost

5.4 Project Workforce Accommodation

The Project will engage a Principal Contractor who will be responsible for organising and managing the accommodation for the project workforce. It is envisioned that the Principal Contractor will utilise an existing camp located on Paru Road which is already established with food and waste facilities.

5.5 Economic Impacts to Local Communities

The tender documentation will contain requirements related to local development. These clauses will outline contract requirements such as:

- Indigenous Participation – To seek to ensure a more active indigenous participation in the Contractor’s activities through maximising employment, development and training opportunities,

including the engagement of the Tiwi people and Tiwi operated businesses, including the Tiwi Islands Regional Council

- Maximising the involvement and enhancing the skills and capability of the Tiwi people
- Maximising the involvement of local and regional industry; and
- Enhancing the skills and capability of local and regional industry.

Following formal handover of the completed project, TIRC will continue to maintain it. As such, it is recognised that local participation during construction will support efficient and cost-effective ongoing maintenance and repair through building local capacity and better knowledge and understanding of the asset.

Ongoing maintenance includes re-sealing; pavement, pothole, and shoulder repairs; line-marking; and replacement of damaged or missing road signs and guide-posts. DIPL will assist TIRC with developing a Maintenance Strategy.

5.6 Social and Economic Benefits of the Project

In recent years, road usage has increased due to increases in the size and diversity of activities stimulated by the establishment of timber plantations and related activities. As a consequence, the existing road network has significantly deteriorated. The existing gravel road and its drainage features are generally in poor condition and are subject to deterioration and inundation during the wet season. This imposes ongoing safety and maintenance issues, as well as constraining economic development when they become difficult, unsafe, or impassable.

As such, significant targeted road maintenance and upgrade work is required to maintain safety and to support local industry to meet ongoing development targets.

The key flow-on social and economic benefits of the Project are summarised as follows:

- Providing all-weather access between the communities and businesses on Bathurst and Melville Islands
- Providing all-weather access to schools including Tiwi College, thereby supporting better education and training outcomes
- Supporting economic growth opportunities, particularly those associated with the potential export of plantation timber
- Creating more employment opportunities from the upskilling of local peoples engaged in the works
- Creating local long-term employment opportunities through supporting the growth of existing enterprises as well as future enterprises (e.g., cultural tourism)
- Creating local business improvement opportunities through their engagement on the Project.
- Supporting business and economic certainty required to facilitate the growth of existing Indigenous enterprises and potential establishment of new Indigenous enterprise on the Tiwi Islands.

6.0 Summary

This supplementary environment report has been developed to address the *Direction to Provide Additional Information* delivered by NT EPA to supplement the *Environment Protection Act 2019 Referral - Environmental Impact Assessment – Paru Road Upgrades – NT Portion 1644, Melville Island* (AECOM, 2021).

AECOM travelled to Melville Island to undertake terrestrial ecology surveys during 4 – 11 October 2021. The objective of this assessment was to determine the presence of Butler's Dunnart and Pale Field-rat within the proposed gravel pits and assess the density of large and very large trees within the proposed gravel pits and provide a comparison with surrounding areas to contextualise the potential impacts of a loss of these trees on habitat availability to threatened species.

A total of 45 pitfall traps, 120 Elliot traps and 22 cameras were installed across the four gravel pits to detect Butler's Dunnart and Pale Field Rat. A total of 11 Butler's Dunnart and three pale Field-rats were detected during the October 2021 survey.

Assessment of large and very large trees determined that there was no significant difference between the number of large and very large trees within the proposed gravel pits, and the number of such trees in similar woodland habitat immediately adjacent to the gravel pits.

Transect surveys and vegetation mapping undertaken within the creek road alignment in January 2021 failed to detect threatened flora associated with monsoon vine forest . Moreover, suitable habitat for these species does not occur within the creek road alignment.

The predominant focus of weed management for the project is to prevent the introduction of weeds onto the Tiwi Islands. This is being implemented by the inspection of plant and equipment at the contractor's office in Darwin prior to mobilisation. Plant and equipment is being inspected for soil and loose vegetation. The project area is currently free of weeds; however regular monitoring will be undertaken, and control methods will be implemented if weeds are detected

Three water sources are proposed for use to support Paru Road upgrade works. An Erosion and Sediment Control Plan (ESCP) will be developed and implemented during the project that will aim to prevent deleterious impacts to creek hydrology, water quality and aquatic habitats. The construction contractor will be required to implement the ESCP, as well as requirements of the NT Land Clearing Guidelines (DEPWS, 2021) and Standard Specification for Environmental Management (DIPL, 2019) to minimise impacts to surface water and groundwater along Paru Road.

The proposed gravel pits have been chosen to minimise impacts to threatened species, predominantly *Typhonium jonesii* and *T. mirabile* that were surveyed in January 2021. Complete avoidance of impacts to threatened species is not possible, due to the abundance of threatened fauna and flora species that occur on Melville Island. The abundance of threatened flora and fauna species on Melville Island is due to the presence of endemic species and subspecies that do not occur on the Australian mainland, such as *Typhonium jonesii* and Tiwi Masked Owl (*Tyto novaehollandiae melvillensis*), and the decline of several fauna species on the Australian mainland that continue to have healthy populations on Melville Island, such as Black-footed Tree-rat and Pale-field Rat. Terrestrial ecosystems on Melville Island remain in good condition. The woodland habitat that will be impacted by the Paru Road upgrade represents a small portion of the terrestrial ecosystems that occur on Melville Island; therefore the project will have significant deleterious impacts to the environment provided effective mitigation measures are implemented.

7.0 References

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Appendix A

Direction to Provide Additional Information (NT EPA)

Northern Territory
Environment Protection Authority

DIRECTION TO PROVIDE ADDITIONAL INFORMATION

This direction is given under regulation 119(2) of the Environment Protection Regulation 2020

Name of proposed action	Paru Road Upgrade
Proponent	Department of Infrastructure, Planning and Logistics
NT EPA reference	EP2021/007
Description of proposed action	To upgrade Paru Road (within NT Portion 1644) on Melville Island. The existing gravel road is the main road from the ferry terminal for transport between Melville and Bathurst Islands to townships on Melville Island. The proposal area would cover 383.8 ha, comprising: • a new bridge or major culvert crossing of a permanent (unnamed) creek • four road realignments to smooth existing bends along Paru Road over a total length of about 3.1 km • two areas for gravel pits • a maximum clearing footprint of 74.4 ha for the gravel pits and road realignment
Nature of proposed action	Infrastructure (roads and transport)
Method of environmental impact assessment type	Assessment by Supplementary Environmental Report (SER)
Direction	The proponent is directed to provide the additional information in the SER as detailed in **Attachment 1:** • to address the submissions received in relation to the referral information • to ensure that the NT EPA has sufficient information to complete the environmental impact assessment process.
Submission period for SER	The SER must be submitted to the NT EPA within 12 months of the date of this Direction.
Person authorised to give direction	Dr Paul Vogel AM – Chairperson, Northern Territory Environment Protection Authority Delegate of the NT EPA under section 36 of the *Northern Territory Environment Protection Authority Act 2012*
Signature	
Date of direction	26 July 2021

Attachment 1 – Additional information requirements for the Supplementary Environmental Report Department of Infrastructure, Planning and Logistics – Paru Road Upgrade, Melville Island

Additional information required to address potential significant environmental impacts to environmental objectives		
Environmental Factor	**Referral Reference**	**Additional Information Required**
Terrestrial ecosystems	Submission from the Department of Environment Parks and Water Security Referral section 3 and 5	• Provide additional survey details to demonstrate confidence about the absence of significant monsoon and riparian rainforest species from the riverine forest associated with the creek crossing on the Paru Road, and/or demonstrate that the habitat is not suitable for the species with potential to occur in this area. • Configure gravel pits to avoid areas in GP1-2 that have not been completely surveyed for *Typhonium* spp. If this is not possible, clarification of *Typhonium* spp. presence/absence and abundance within GP1-2 through additional survey is required to ensure there is no significant impact on these species. • Undertake sufficient additional survey within the proposal footprint to ensure that gravel pits can be located within areas where Pale Field-rat and Butler's Dunnart are known to be absent. If this is not possible, additional regional survey would be required to clarify the significance of the local occurrence of these species. • Undertake additional sampling to assess the density of large (DBH>40cm) and very large (DBH>50cm) trees with the potential to support tree hollows within the areas proposed for clearing, and provide a comparison with densities in surrounding areas of similar habitat to contextualise the potential impacts of loss of large trees on habitat availability for relevant threatened species (Masked Owl, Brush-tailed Phascogale and Black-footed Tree-rat). Areas with relatively high densities of large hollow-bearing trees should be avoided where possible. • Provide further detail on the duration and content of the proposed weed management program to clearly demonstrate that the measures put in place to monitor the establishment, spread and control of weeds will minimise any risk to threatened species and their habitat. • Provide Rehabilitation Plans for the gravel pits and the sections of Paru Rd to be replaced by the realignment works
Hydrological processes, Inland water environmental quality, and Aquatic ecosystem	Submission from the Department of Environment Parks and Water Security Referral section 3 and 5	• Provide details about the amount of water that the proposal is expected to use and water source that will be used. If water is to be sourced from local aquifers, a groundwater resource assessment should also be undertaken in relation to water availability and suitability

Additional information required to address potential significant environmental impacts to environmental objectives		
Environmental Factor	**Referral Reference**	**Additional Information Required**
		• Provide details to demonstrate construction of the road would be designed to maintain natural flow regimes upstream and downstream of the road crossing the drainage lines and drainage of water from the road itself • Provide details about the proposed creek crossing and measures to avoid any significant impacts to the creek hydrology, water quality and morphology of the aquatic habitat • Provide details about the proposed North Road Realignment at Ch5300 – Ch6300 and the gravel pits to be developed within the Gravel Pit 1 Area and how impact to the drainage lines and 1st order ephemeral streams adjacent to these works will be avoided. • Clarify the presence and extent of any aquatic habitats within or adjacent to the proposed works and outline specific measures to be put in place to ensure potential impacts on sensitive receiving habitats are minimised through environmental management and erosion/sediment control systems
Community and economy	Submission from the Department of Chief Minister and Cabinet Referral section 5.13, 5.15	• Provide information about consultation undertaken and planned with the local community, and how matters raised related to potential significant impacts have been and/or will be considered and addressed • Provide details about the proposed workforce including whether there will be opportunities to train and employ members of the local community. Information on remote town job profiles, including at Pirlangimpi, Milikapiti, and Wurrumiyanga in the Tiwi Islands, can be found at https://nt.gov.au/employ/for-employers-in-nt/skills-existing-and-needed/remote-town-job-profiles • Describe the potential adverse impacts to road users during construction, and how such impacts will be minimised • Describe the logistics of accommodating the project workforce, and demonstrate measures to minimise any potential adverse impact on the wellbeing of the community • Provide an assessment of the potential economic impact of the construction/works on local communities • Provide an assessment of the flow-on social and economic benefits for local businesses and communities as a result of the proposal

Appendix B

Weed Management Program and Gravel Pit Rehabilitation Plan

Weed Management Program

During the construction works, the Contractor will be required to implement an approved Weed Management Plan in line with NTG Standard Specification for Environmental Management which states the following:

"Provide a copy of a site specific and project specific Weed Management Plan (WMP) in accordance with Australian Government and Northern Territory Government guidelines. A WMP is required if Declared Weeds or Weeds of National Significance (WoNS) are known to be present or have potential to be established and/or spread on site.

Land managers, including the Department and its Contractors, are legally responsible for the prevention of spread and control of Declared Weeds in accordance with the Weeds Management Act regardless of the size of project.

For all projects, Contractors must:

- *Survey for declared weeds and assess risk of spread,*
- *Consult with Local Council and the Department of Environment, Parks and Water Security (DEPWS) Weed Management Branch about management procedures to be implemented by the Contractor*
- *Eliminate the seed source where possible*
- *Establish weed control protocols to prevent spread of weeds and their seeds*
- *Practise on-going weed hygiene.*

If DECLARED WEEDS (plants identified by DEPWS requiring control, eradication or prevention), and/or ALERT WEEDS (to be immediately reported to DEPWS), and/or Weeds of National Significance (WoNS), are identified on site, a detailed WMP is to be submitted with the CEMP."

The NTG Standard Specification for Environmental Management also outlines requirements for prevention of weed spread, and cleaning of vehicles and plant.

The key focus for weed management is avoidance. Any machinery transported to Melville Island is required to have the equipment thoroughly cleaned and a cleaning certificate/declaration carried with the machinery. On arrival on Bathurst a representative of the Tiwi Land Council (TLC) will meet the ferry and undertake an inspection and provide approval to leave the ferry terminal for the project.

After the works have been completed, the assets will be returned to Tiwi Islands Regional Council (TIRC) for ongoing maintenance and care.

TLC will continue their Weed Management Program (a program developed for the prevention of weed spread across the Tiwi Islands).

Gravel Pit Rehabilitation Plan

The Contractor will be required to submit a Gravel Pit Management Plan to DIPL for assessment and endorsement. The purpose of the Gravel Pit Management Plan is to document all necessary steps and tasks required in establishing the nominated gravel pit to enable construction of the Paru Road Upgrade works and primarily to ensure the following is achieved:

- The timely, efficient, and comprehensive management of all pit-related activities; and
- The smooth handover of the nominated gravel pit back to TIRC.

The sections of Paru Road that are 'relocated' will be scarified and rehabilitated to prevent access and encourage vegetation growth. The old Paru Creek crossing will be decommissioned and removed from site, with the area rehabilitated as above. Topsoil from the new alignments will be stockpiled at the laydown area or pits and be utilised in spreading across the decommissioned sections of road to increase the potential for native species seed bank germination and recruitment.

The Gravel Pit Management Plan will be required to meet the standards of Clause 35 (Rehabilitation of extraction areas, detours and access tracks) of NT Government Standard Specification for Environmental Management, which states the following:

Progressively rehabilitate extraction areas to reduce the area of exposed soil during construction works.

Following excavation of the required material, any unused rock and gravel material is to be spread back over the extraction area. The extraction area "floor" is to be ripped using dozer or grader tynes to a depth of 100 mm to 200 mm to loosen the floor to encourage new plants to establish. Ripping is to be carried out along contour lines to reduce erosion.

The previously stripped and stockpiled material including topsoil and overburden is to be pushed back over the excavation, detour or access track. The stockpiled topsoil is to be spread over the disturbed areas to encourage regrowth from the soil's seed store. The surface of the topsoil is to be scarified along the contours which will further enhance the ability of the material to trap mobile seeds, dust and moisture.

Where specified in the RFT/RFQ native seed will be broadcast either by hand or machine across disturbed areas.

Cleared vegetation from the project areas, detours, access tracks, and extraction areas is to be spread over areas being rehabilitated prior to demobilisation to assist the re-colonisation of flora and fauna across the site.

Appendix C

Butler's Dunnart and Pale Field-rat photos

Fauna Photos

Plate 2 Butler's Dunnart at GP 2-1 in pitfall trap

Plate 3 Butler's Dunnart at GP2-1 in pitfall trap

Plate 4 Butler's Dunnart at GP2-1 detected on camera

Plate 5 Butler's Dunnart at GP2-1 detected on camera

Plate 6 Butler's Dunnart at GP 1-1 detected on camera

Plate 7 Butler's Dunnart at GP 1-1 detected on camera (pregnant female)

Plate 8 Butler's Dunnart at GP 1-2 in pitfall trap

Plate 9 Butler's Dunnart at GP 1-2 in pitfall trap

Plate 10 Butler's Dunnart at GP 1-3 in pitfall trap

Plate 11 Butler's Dunnart caught at GP 1-3 (pregnant female)

Plate 12 Butler's Dunnart at GP 1-3 detected on camera

Plate 13 Probable Pale Field-rat at GP 1-1 detected on camera

Plate 14 Pale Field-rat at GP 1-2 detected on camera

Plate 15 Pale Field-rat at GP 1-2 detected on camera

Appendix D

Habitat Tree Count

Habitat Tree Count

Table E Habitat Tree Count

Site name	Easting	Northing	Large Tree	Very Large Tree
Habitat Tree Count INSIDE Gravel Pit Areas				
1	680450	8703210	13	4
2	680587	8703190	8	4
3	680689	8703240	7	6
4	680569	8703280	12	2
5	681099	8703380	6	4
6	681043	8703430	9	5
7	680097	8701940	3	1
8	680183	8701980	1	0
9	680186	8702150	1	0
10	680140	8702270	1	0
11	683609	8706920	5	3
12	683409	8706960	7	6
13	683569	8707000	8	2
14	683729	8707000	8	3
15	683529	8707080	9	2
16	683649	8707080	6	2
17	683569	8707160	6	0
18	683849	8707160	4	5
19	683836	8707310	7	4
20	683649	8707240	5	3
21	683769	8707240	7	6
22	683929	8707240	10	1
23	683729	8707320	7	5
24	683932	8707340	4	2
25	683994	8707400	5	5
26	683809	8707440	3	0
27	684009	8707480	2	0
28	683889	8707520	3	0
29	683929	8706840	7	1
30	684089	8706960	4	2
		Total	**165**	**78**
Habitat Tree Count OUTSIDE Gravel Pit Area				
h1	680529	8702280	2	0
h2	680729	8702280	1	2

Site name	Easting	Northing	Large Tree	Very Large Tree
h3	679953	8702430	4	1
h4	680108	8702440	4	1
h5	680769	8702520	6	1
h6	680209	8702600	8	7
h7	680329	8702800	7	5
h8	680809	8702840	4	5
h9	680524	8702890	9	5
h10	680489	8703000	12	3
h11	681141	8703140	10	3
h12	681256	8703260	10	8
h13	680849	8703360	5	5
h14	681455	8703370	2	0
h15	681549	8703420	2	1
h16	681689	8703490	8	1
h17	681369	8703520	7	1
h18	680929	8703600	4	6
h19	681049	8703680	3	1
h20	681529	8703760	3	0
h21	684329	8707160	6	3
h22	684236	8707270	6	2
h23	684405	8707450	5	1
h24	684889	8707520	1	1
h25	684209	8707600	8	2
h26	685009	8707640	5	1
h27	684449	8707680	6	4
h28	684369	8707720	8	4
h29	684209	8707880	5	2
h30	684329	8707960	4	2
Total			**178**	**78**

Appendix E

Water Supply Investigation Report (Territory Groundwater Services, 2019)

Territory Groundwater Services Pty Ltd

Water Supply Investigation Paru Road, Melvillle Island, Tiwi Islands

A report prepared by Maria Woodgate (TGS) for the NT Department of Infrastructure, Planning and Logistics.

28 November 2019

Contents

COMMONLY USED ABREVIATIONS

AHD	*Australian Height Datum*
mBGL	*metres below ground level*
EC	*Electrical Conductivity – measured in microSiemens per centimetre – µS/cm*
L/s	*Litres per second*
PMP	*Plantation Management Partners*
RN	*Registered bore number*
TGS	*Territory Groundwater Services P/L*
TRLC	*Tiwi Regional Land Council*
VDS	*Van Diemen Sandstone*

Introduction

Melville Island is part of the Tiwi Islands, just over 50km directly north of Darwin, NT. The roads on the island have deteriorated in recent years due to increased usage. The NTG has responded by allocating funds for road upgrades. This funding will be used to undertake road upgrades along Paru Road – a stretch of dirt road between the inter-island ferry landing and the intersection known as '3-ways' approximately 12km to the north. (see Figure 1). The proposed road works will require a temporary water supply. An estimate of water demand would be approximately 10 L/s for the proposed 12km section of roadworks.

The division of Transport and Civil Services of the Department of Infrastructure, Planning and Logistics has engaged *Territory Groundwater Resources Pty Ltd* (*TGS*), to review and assess the existing bores, and groundwater resources in proximity to the road and advise on the available resources suitable for the proposed roadworks.

TGS undertook a desktop assessment and a site visit in September 2019. The aim was to locate any potentially useable existing bores, and to identify prospective drilling targets to meet the expected roadworks water demand within a water carting practical distance of no more than 8km. Note that water quality has not been necessarily taken into account as the roadworks can utilise brackish-saline water if necessary. The results of this assessment are presented in this report.

Previous Studies

The groundwater resources of the study area were first investigated in 1963 by Barclay. He sought to establish a domestic water supply for the Paru outstation community situated on the northern banks of the Aspley Straits. Broader island-wide groundwater studies (Haig et al., 2003), provide a good overview of the hydrogeology of the region.

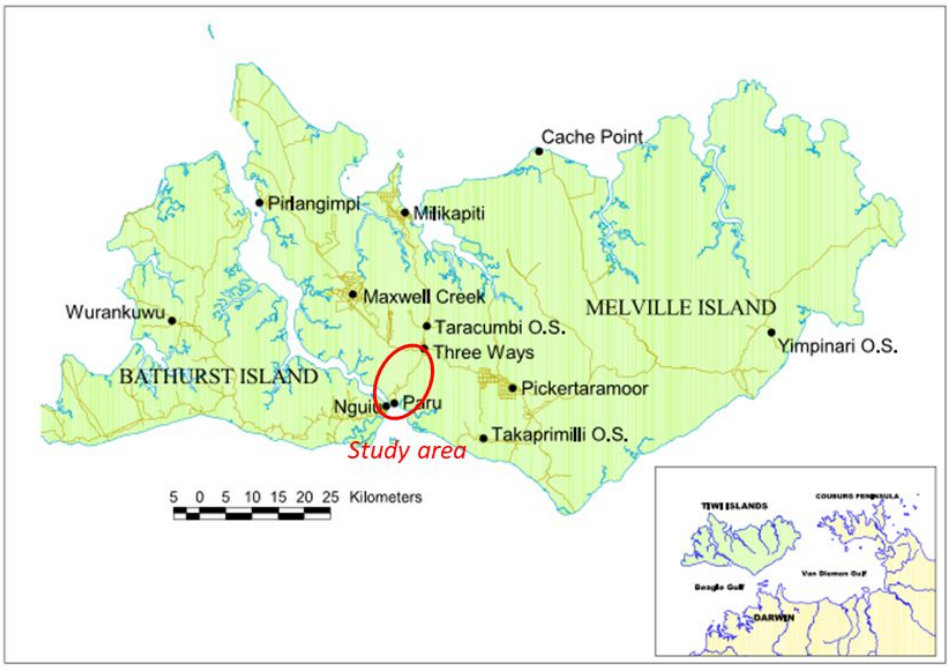

Figure 1 Paru Road Location

Site Description

The Paru Road tracks northward from the Aspley Straits increasing in elevation from sea level in the south to approximately 116 mAHD just south of the 3-ways intersection. The topography and existing bores are shown in Figure 3.

Landform and Vegetation

The southern end of the road features low lying coastal flood plains which are subject to tidal inundation and seasonal flooding. The northern end rises to a dissected plateau or broad ridge where the lateritic Van Diemen Sandstone forms a resistant capping.

The surrounding vegetation consists predominantly of open forest.

Climate

The climate of the region is dominated by a distinct monsoonal wet season (October to April) and dry season (May to October). The area is subject to tropical cyclones during the wet season. Mean annual rainfall is approximately 2,005mm (measured at the Pirlingimpi airport), the bulk of which falls in the wet season as shown in Figure 2.

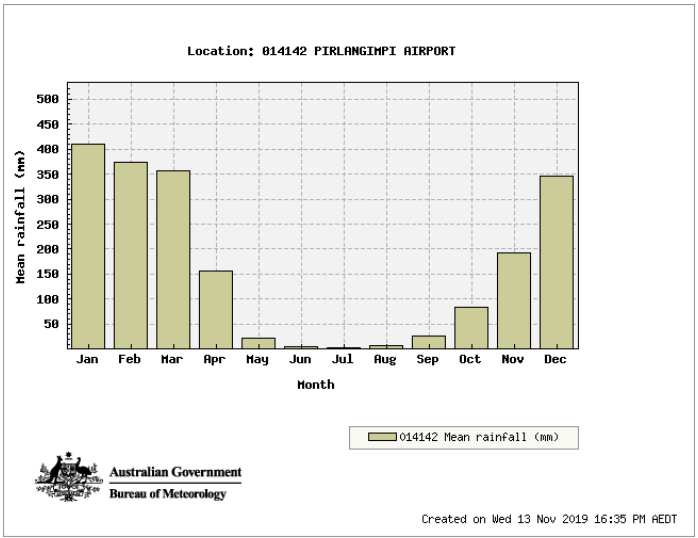

Figure 2 Mean Monthly Rainfalls at Pirlangimpi Airport

Surface Water

At the southern end of the road a number of estuarine creek systems flow into the Aspley Straits. Further north, small creeks and streams are generally ephemeral but there are occasional small waterholes/springs which are probably fed by the underlying aquifers in the latter part of the dry season. One of these springs is used as the domestic water supply for the Paru Outstation 5km south.

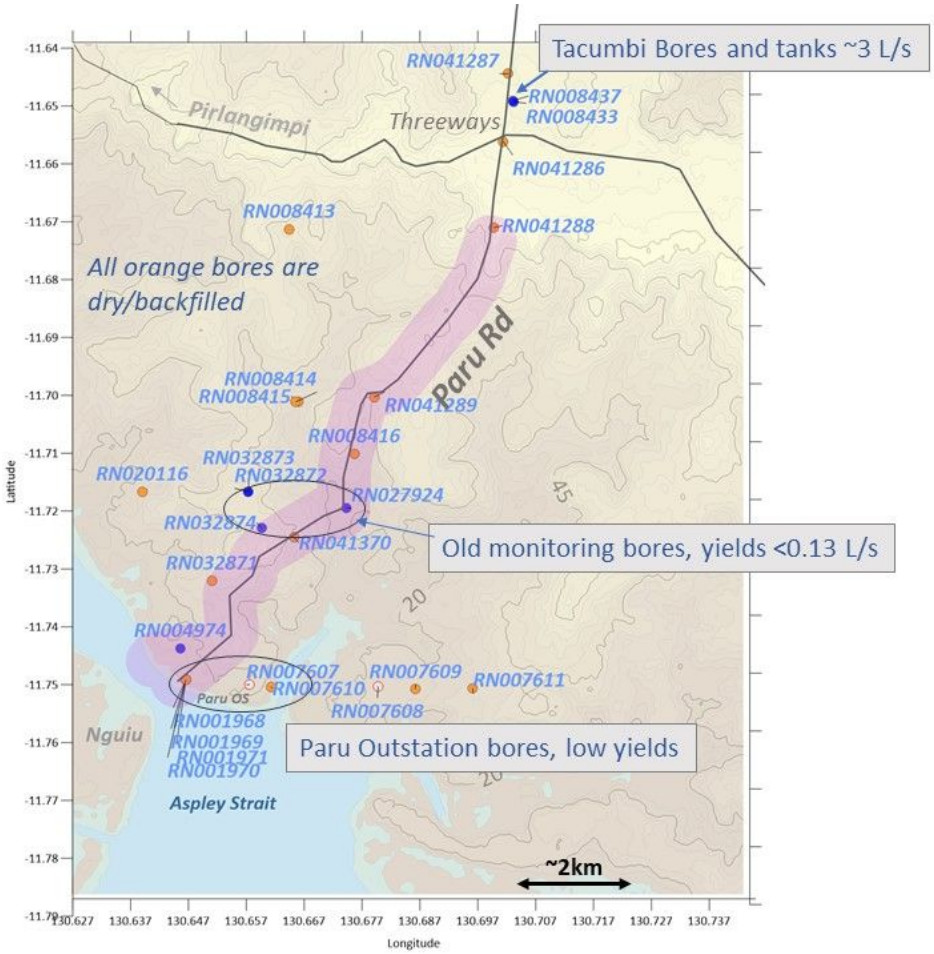

Figure 3 Existing bores and Other Features (the pink shows where the road repairs are planned)

Regional Geology

The study area is covered by the Melville Island, SC 52-16, 1:250 000 geological mapsheet.

The Tiwi Islands are situated in the Money Shoal Basin. The Proterozoic basement consists of igneous and metamorphic rocks. Overlying the basement is a thick sequence, (700+ metres), of gently dipping Cretaceous sedimentary strata known as the Bathurst Island Formation, consisting of mainly fine-grained rocks such as the mudstones of the Moonkini Member. These are unconformably overlain by the Tertiary Van Diemen Sandstone (VDS). The sandstone covers most of Melville Island and is thickest where the higher ground occurs such as at the northern end of the Paru Road. The top of the sandstone has typically weathered to a lateritic profile. Toward the coast, this formation has eroded away completely.

A summary of the stratigraphic succession is shown in Figure 4.

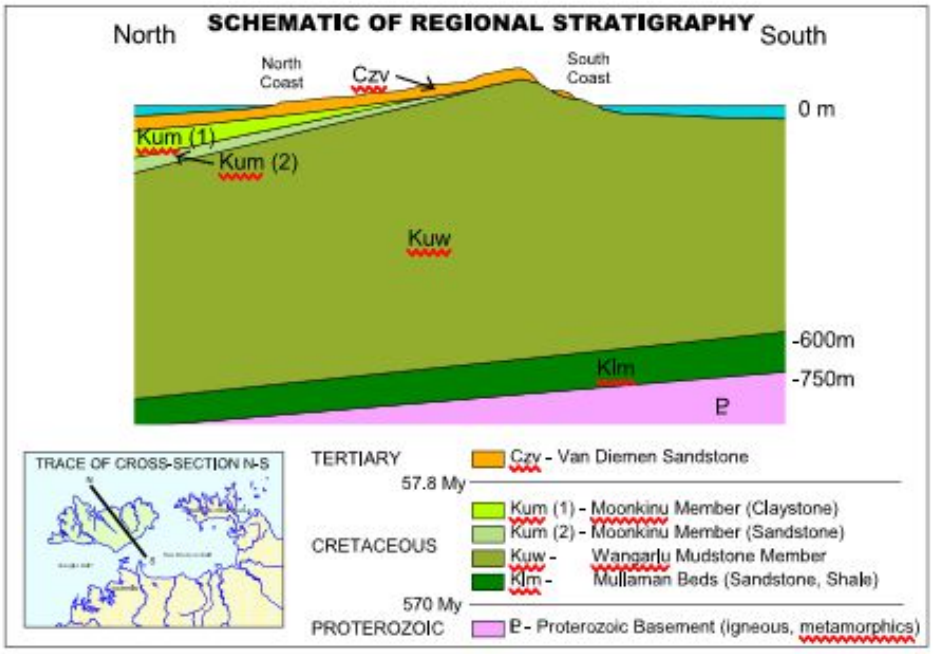

Figure 4 Schematic of Melville Island Stratigraphy (after Haig et al., 2003).

A large part of the study area is covered in Quaternary alluvium and coastal sediments providing a patchy cover of sands, silts and gravels. The surface geology of the study area is shown in Figure 5.

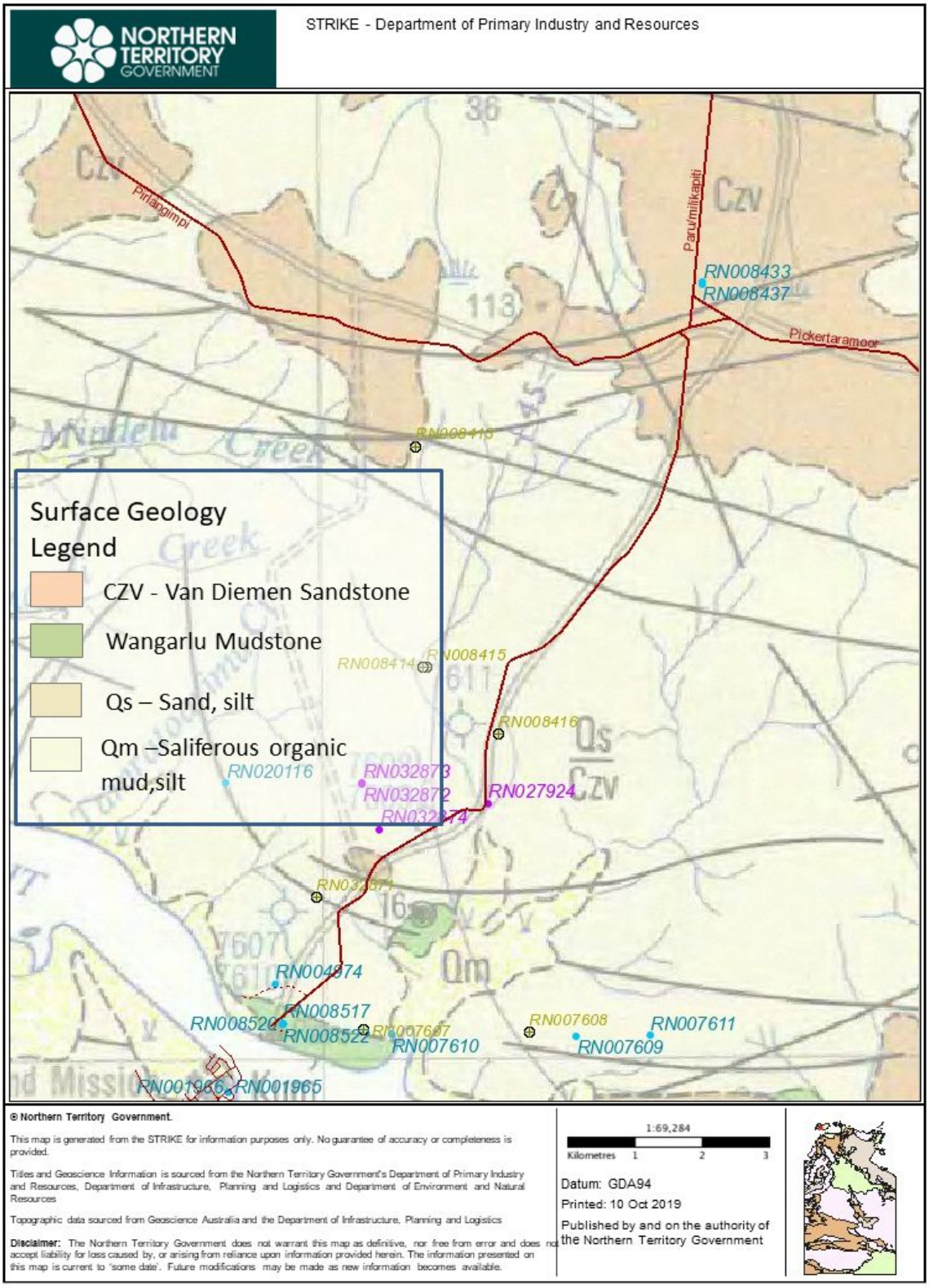

Figure 5 Surface Geology Paru Road Area

Hydrogeological Assessment

This assessment is based on a review of all available bore logs, spatial data including maps, digital geological, geophysical, topographic, and satellite data, and existing reports.

Existing Bores

Figure 3 shows the existing bores in the study area and Table 1 describes the main features of these bores.

In summary, around 27 bores up to 222 m depth have been drilled in the vicinity of the Paru Road. Only 2 of these have yielded >1 L/s – the two bores at the Taracumbi plantation area, approximately 700m north of the 3-ways intersection. Very small supplies have been intersected west of the Paru road where the Van Diemen Sandstone is slightly more than 10m thick.

At the southern end of the road, the Paru outstation, with numerous failed bores, currently draws its water supply from a small spring/ perennial water hole 5km north of the community. This attests to the difficulty of obtaining adequate bore water at the southern end of the study area.

Table 1 Existing Bores within 5km Paru Road Area

Bore no	Bore name	Drill year	Thickness VDS	EC (uS/cm)	Yield (L/s)	Drilled depth (m)	Water level (m)	Latitude	Longitude
RN020116		1979	0		0	19	0	-11.716632	130.639029
RN007610	PARU NO. 4	1971	6		0	22.9	0	-11.750408	130.661239
RN007611	PARU NO. 5	1971			0	15.1	0	-11.750655	130.696102
RN001971	WELL G	1959			0	0	0	-11.749137	130.646552
RN001968	WELL D	1959			0	0	0	-11.749137	130.646552
RN004974	INVESTIGATION BORE COCKLE PT. NO. 1	1972	6		0	3	0	-11.743718	130.645602
RN007609	PARU NO. 3	1971	0		0	19.8	0	-11.750713	130.686194
RN001970	WELL F	1959			0	0	0	-11.749137	130.646552
RN001969	WELL E	1959			0	0	0	-11.749137	130.646552
RN032874	PARU 4/00 (monitoring bore)	2000	12	88	0.13	15	4.5	-11.722894	130.659701
RN032873	PARU 3/00 (monitoring bore)	2000	15		0.1	18	4.75	-11.716634	130.657361
RN008437	Taracumbi (PRODUCTION BORE NO. 2)	1974	34		3.5	24.7	0	-11.649064	130.703116
RN008433	Taracumbi (PRODUCTION BORE NO.1)	1974	34	29	3.5	58	0	-11.649302	130.703206
RN027924	PARU 1/91 (monitoring bore)	1991	9		0.01	97.1	7.91	-11.719451	130.674309
RN032872	PARU 2/00 (monitoring bore)	2000	15	1000	0.15	168.7	0	-11.716688	130.657343
RN041286		2019	26		0	30		-11.65614	130.7014
RN041287		2019	24		0	25		-11.64442	130.70224

Bore no	Bore name	Drill year	Thickness VDS	EC (uS/cm)	Yield (L/s)	Drilled depth (m)	Water level (m)	Latitude	Longitude
RN041288		2019	32		0	42		-11.67101	130.69979
RN041289		2019	3		0	42		-11.7003	130.6791
RN041370		2019	3		0	54		-11.72448	130.66522
RN008415	MEL. 74/4	1974	8		0	23	0	-11.701112	130.665989
RN008416	MEL.74/1	1974	4		0	75	0	-11.710095	130.675674
RN008413	MEL. 73/2	1973	0		0	70	0	-11.671289	130.664435
RN008414	MEL. 74/3	1974	7		0	24	0	-11.701114	130.66553
RN007607	PARU #1	1971	0		0	30.5	0	-11.749977	130.657557
RN007608	PARU NO. 2	1971	0		0	36.6	0	-11.750299	130.67977
RN032871	PARU 1/00	2000	0		0	222.7	0	--11.732061	130.651093

Local Geology and Hydrogeology

Regional Groundwater Mapping was undertaken in 2003, (Haig & Matsuyama, 2003), to produce the maps and reports entitled: Water Resources of the Tiwi Islands Map 2. These provide a good basis for this assessment.

The Van Diemen Sandstone, together with any overlying laterite and alluvium, forms the regional shallow aquifer system (Haig et al, 2003). Local yield and groundwater storage depends on the thickness of the sandstone. This sandstone hosts very fresh water, (salinity, measured as electrical conductivity, EC of <100 uS/cm), and is the best aquifer available wherever it occurs. Due to the strong seasonality of the rainfall in Tiwi Islands monsoonal climate, the water table in the Van Diemen aquifer ranges by around 6 metres annually, (eg. hydrograph for RN008437).

The thickness of the sandstone is greater at the northern end of the road and virtually non-existent in the middle and at the southern end as shown in Figure 6. It is the saturated part of the VDS, ranging from 10-30m, (hatched in Figure 6), that is water bearing and normally the primary target for production bores.

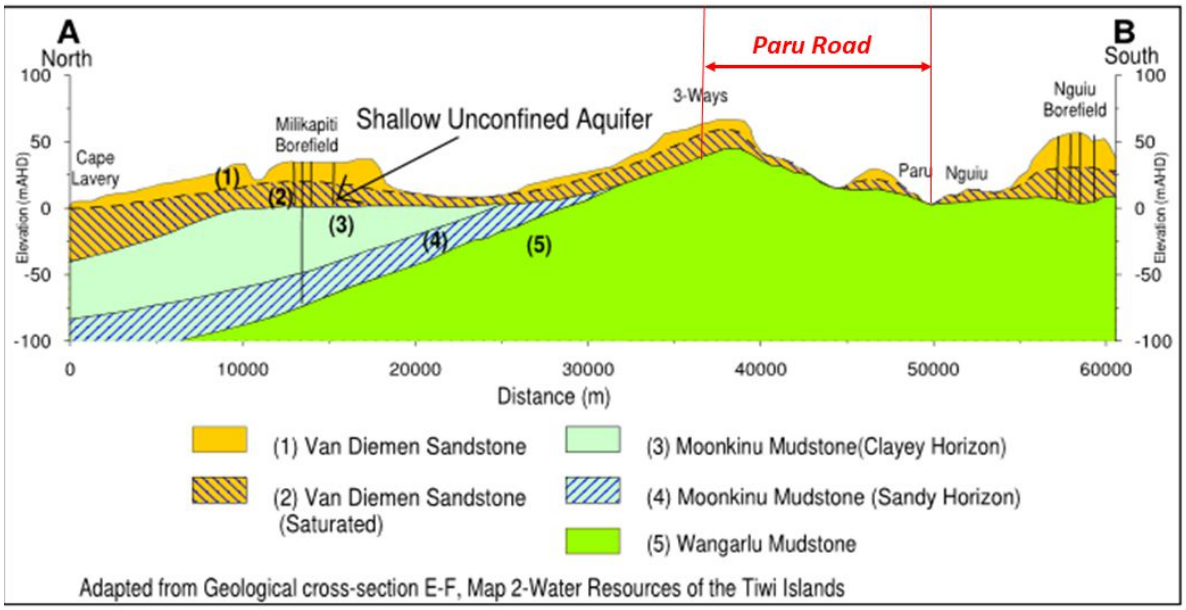

Figure 6 Hydrogeological Cross Section showing Paru Road Section

The thickness of the VDS in the study area was further interpreted from the existing and recent bore logs and is shown in Figure 7. The only productive bores in the area, (the Taracumbi bores RN008433 and RN008437), intersected 34 m of sandstone and a moderate supply of fresh water. Elsewhere in the study area the sandstone is unproductive due to insufficient thickness of sandstone. Accordingly, the Paru Road area was mapped by Haig et al (2003) as having little chance of water in their aquifer potential mapping due to the absence of saturated VDS, (see Figure 8).

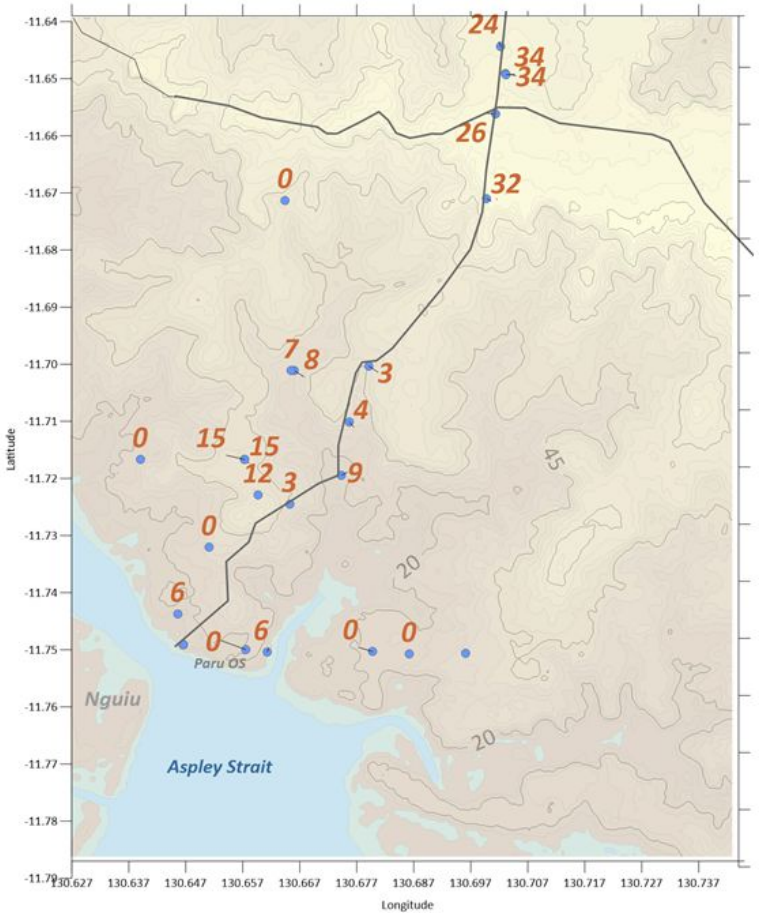

Figure 7 Interpreted Thickness of Van Diemen Sandstone from Bore Logs

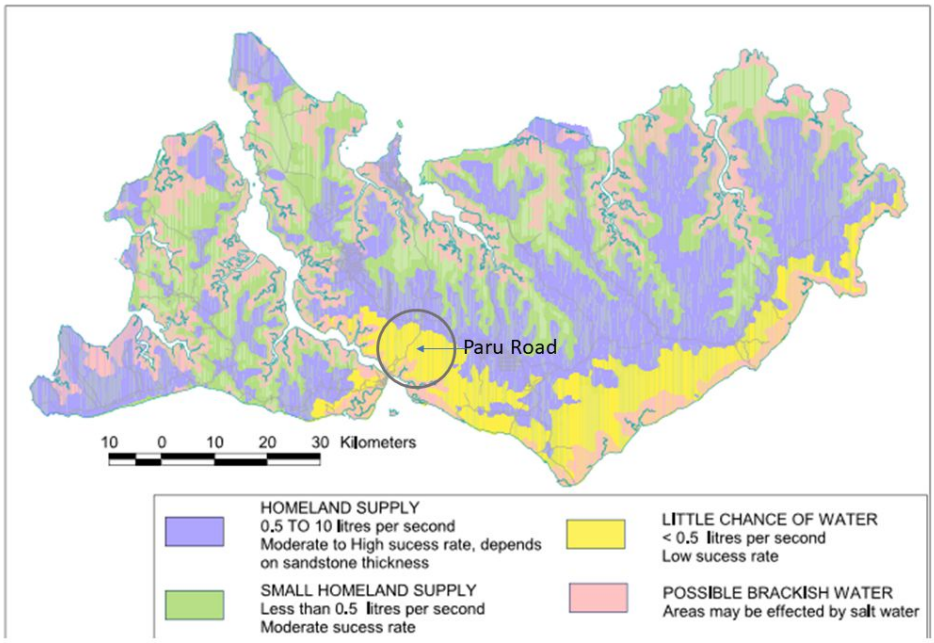

Figure 8 An excerpt from the Aquifer potential mapping of the Tiwi Islands (after Haig et al 2003)

Water Supply Strategy - Recommendations

As has been demonstrated, there are no productive bores along the Paru Rd, or at the Paru Outstation and there is little chance of establishing water supply bores south of the 3-Ways intersection. The following options are recommended:

Option 1: Access Local Surface Water

A water supply could be drawn from two streams which have significant flows from the Wet Season (Jan – Feb?) through to July in the dry season, *(personal communication Quentin Pope, PMP).* Site 1 stream crosses the Paru Road around 5km north of the barge landing. Site 2 is situated on the road into Taracumbi outstation, approximately 6km north of 3-Ways, (Figure 9). There is a standpipe at this site.

A Land- use resource proposal (LURP) form would need to be submitted to the Tiwi Land Council, *(contact - Kate Hadden),* to extract water. The LURP application process is underway.

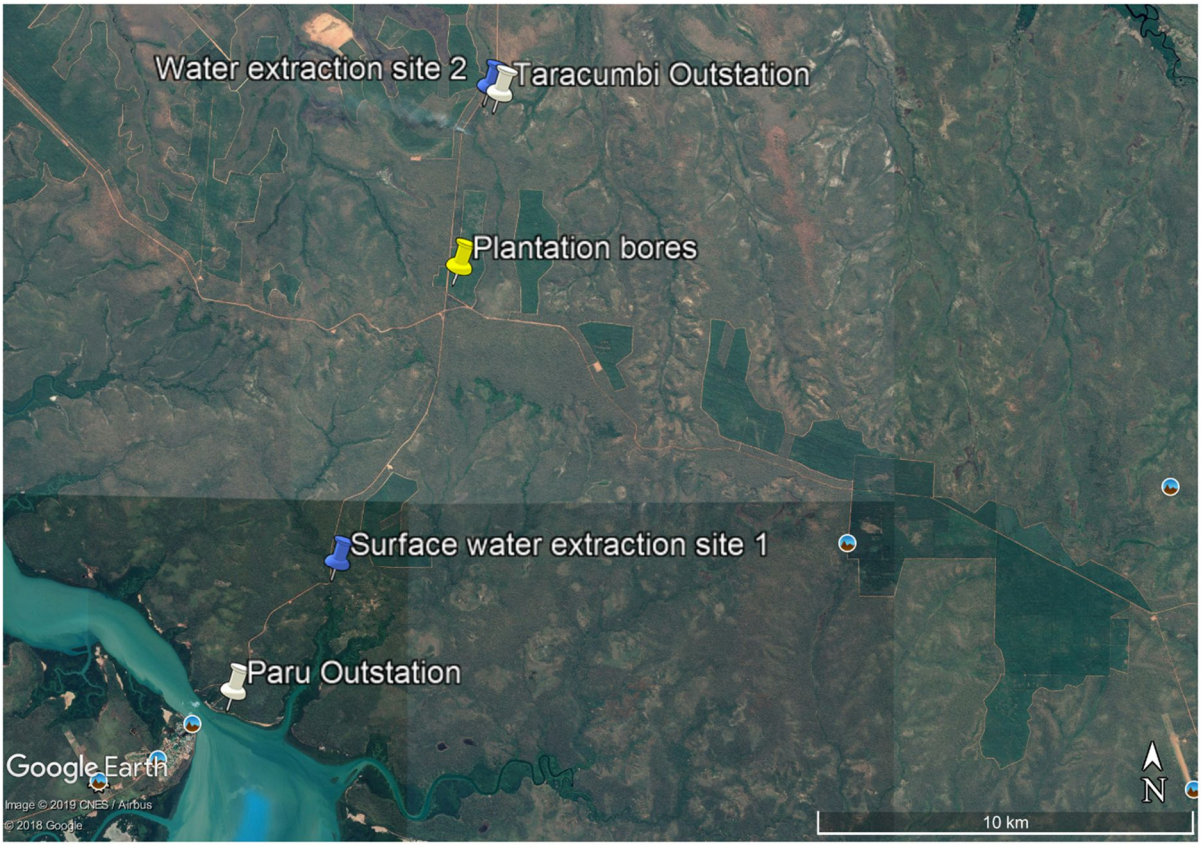

Figure 9 Location of Post-Wet Season Surface Water Sources

If roadworks continue beyond July, the stream flow will decline to the point where it is too low to extract significant volumes of water and Option 2 should be enacted.

Note that the Paru outstation draws its water supply from the 1st location and any extraction must not interfere with the availability of water for the outstation.

Option 2: Access Existing Taracumbi bores- RN008433, RN008437

Currently an estimated 3 L/s is produced by these bores. The bores are used intermittently and are under the jurisdiction of the PMP, *(contact - Quentin Pope).* Use will need to be negotiated around PMP operational requirements at the time of the roadworks.

These bores are around 2.5km from the northern end of the proposed roadworks and over 13km from the southern end. This is less than ideal but could be managed with temporary storage established at some half-way point to provide flexibility. DIPL should consider bring a tank farm to balance storage – otherwise use of the existing tanks at the bore site might be negotiated with PMP.

Option 3 – Drill a New Roads bore

If Option 2 is not available, it might be worth drilling a new roadworks bore in proximity to RN008433 with the aim of intersecting the same aquifer. Although the recent drilling of RN041287 yielded no water, I suspect a slightly deeper bore, or drilling closer to RN0008433 would be have a reasonably good chance of success. A sacred site clearance process would be required before selecting an exact site.

Conclusions

A desktop assessment of hydrogeological conditions in the study area been completed using all available data. The only known shallow regional aquifer is the Van Dieman Sandstone. There are no known deeper aquifers in the study area.

Recent drilling results along the road have been unsuccessful and there appears to be little chance of intersecting water anywhere south of 3-Ways. There is not enough saturated thickness of the Van Diemen Sandstone to yield more than insignificant supplies. This situation is probably compounded by the poor wet season which preceded the 2019 drilling program, resulting in low recharge to the aquifers.

The only prospective aquifers are north of 3-Ways where two existing bores yield an estimated 3 L/s.

The recommended water supply strategy for the Paru roadworks is:

- At the end of the wet season extract surface water from 2 identified stream sites until June then switch to use of the plantation bores identified in this report. Use seawater wherever possible to augment freshwater sources.

This strategy depends on a) permission being given to use the above water sources via Tiwi Land Council in the case of the surface water, and PMP in the case of the bores. (This process is underway)., and b) having an at least average 2019/2020 wet season to generate adequate stream flow.

The only other option is to drill another bore in the vicinity of the Taracumbi Bores which will require clearance and site negotiations.

References

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